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the Illinois Technograph

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MAY, 1949

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TWENTY-FIVE CENTS

Gulf of Mexico is site of newest oil "boom"

OIL WELL SUPPLY COMPANY PLAYS IMPORTANT ROLE IN PROJECT

"More than 4 billion barrels"—that's what one person has estimated as the amount of oil in one 30 mile strip in the Gulf of Mexico—scene of one of the biggest oil exploration projects in history. More than 20 million dollars has been spent by several companies in leasing properties on this newest oil province.

Oil Well Supply Company—a subsidiary of United States Steel Corporation—is supplying many of the oil companies with complete drilling rigs, including rotary drilling units, slush pumps, derricks, swivels, blocks, rotary feed controls and other important parts of rigs.

Since 1862, when it was founded, "Oilwell" has been one of the leading suppliers of oilfield equipment. Not only has it pioneered many improvements in equipment, but it has introduced many new types of machinery and equipment.

This pioneering of more efficient and more economical equipment is a most significant phase of "Oilwell's" progress. For back of all the development work are the objectives to drill cheaper and to produce more economically from any depth.

Opportunities

The fascinating work being done by Oil Well Supply Company, as well as projects being carried on by other U. S. Steel Subsidiaries, requires qualified men in just about every branch of engineering. If you would like to take part, why not see your Placement Officer and talk it over with him. And be sure to ask him for a copy of the book "Paths of Opportunity in U. S. Steel."

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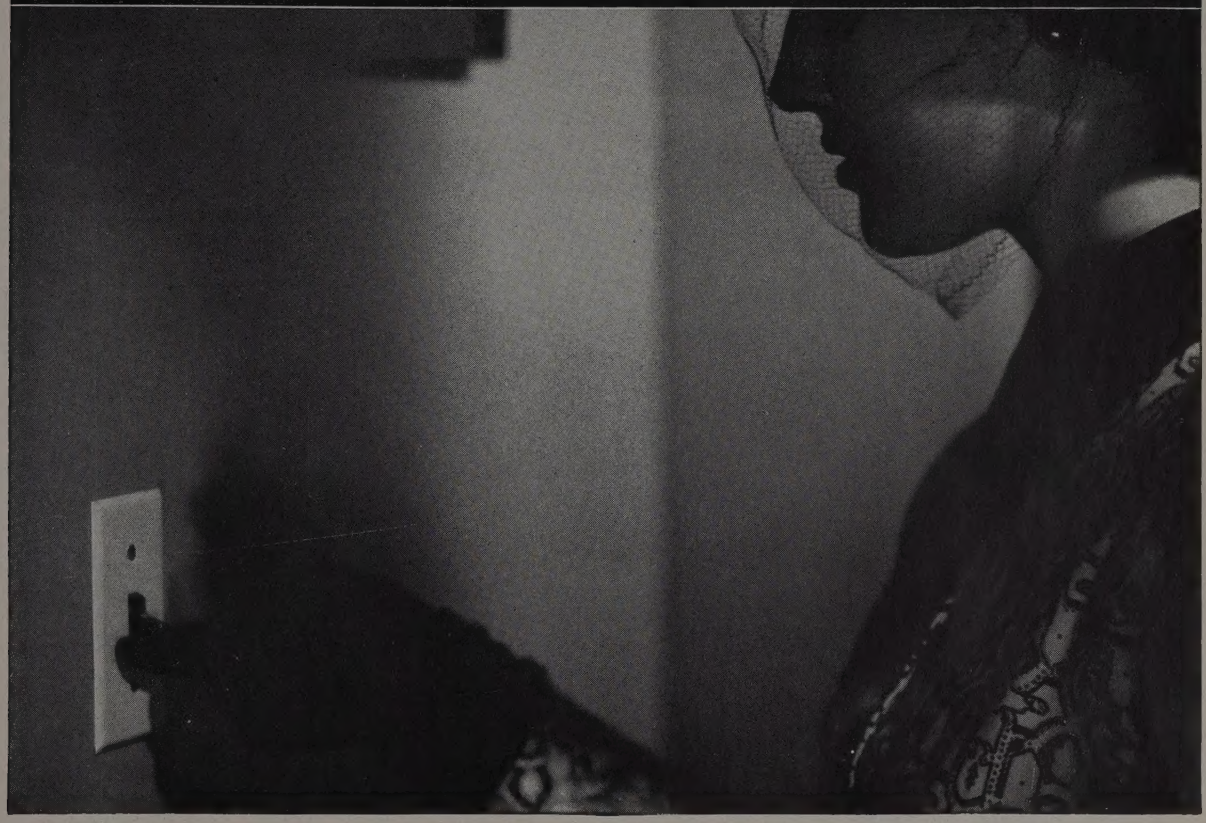
UNITED STATES STEEL

CORNING... DOES THE UNBELIEVABLE WITH GLASS



A new kind of light

where it will lead nobody knows

Soon it will be possible for you to step into your home or office and turn on a light that's different from any you've ever used before.

From a panel in the ceiling will come even, glareless rays to shine on your desk, your chair, your table—but never with uncomfortable brightness, never in your eyes.

The light itself will come from electric bulbs or tubes like those you use now. But it will *behave* far differently because it will shine through a ⅛-inch sheet of a new kind of glass—Fota-lite—a recent development of Corning Glass Works.

Formed inside this sheet is a crisscross pattern of strips of white glass extending through the full thickness of the glass. The squares enclosed by the white strips are crystal clear.

Light from the bulb above—shining through this patterned glass at slantwise angles—is diffused and causes no glare. You get an even, soft light through the entire room—as well as light channeled directly downward through the clear squares to the objects you need to see closely.

This new glass is made by mixing small amounts of rare metals in with the sand before it is melted to form glass. These materials make the whole sheet of glass photo-sensitive—through and through—so that any desired design (such as the one mentioned) may be formed inside the glass by a special process.

In fact, similar photo-sensitive glass is currently being used to print photographs in glass—pictures that can last for thousands of years.

Use of Fota-lite for indoor lighting is its first industrial application. Many other applications—such as its use in instrument panels for cars, in street lighting, and in illuminated signs—are being thoroughly explored.

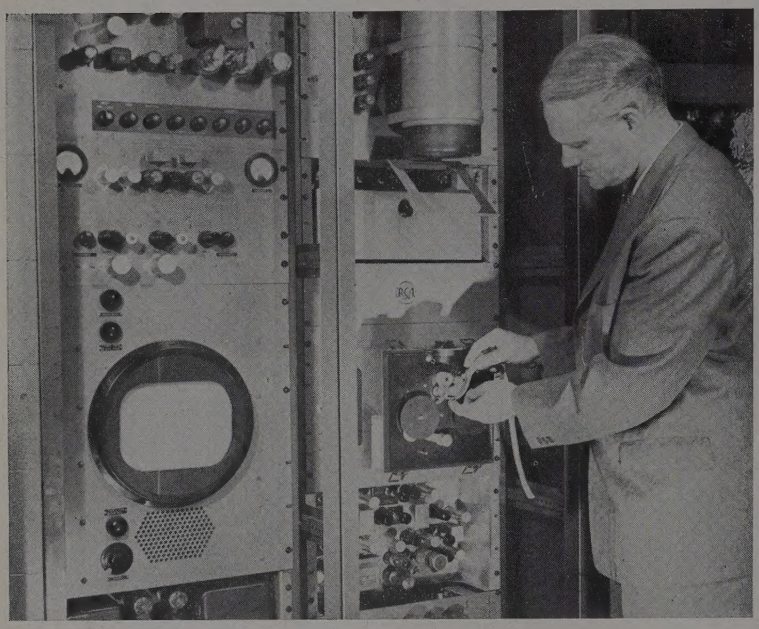
In 98 years of glass-making Corning has developed glass into one of the most versatile engineering materials there is. There are more than 50,000 glass formulas on file at Corning, and the number is growing continually as new developments such as this photo-sensitive glass come out of the laboratory.

That's a good thing for you to remember. For some day, when you've picked the business you want to work in, one of these glass developments—or one now in the research stage—may be just the material you'll be looking for to improve a product or a process.

CORNING GLASS WORKS
CORNING, NEW YORK.

New Developments

By Leonard Ladof, E.E. '49
and Henry Kahn, Ch.E. '50



C. J. Young of the RCA laboratories loads the camera which copies the incoming messages received by the Ultrafax equipment in front of him. (Photo courtesy of R. C. A.)

"Ultrafax"—A Million Words A Minute

Ultrafax, a newly developed system of television communications capable of transmitting and receiving written or printed messages and documents at the rate of a million words a minute, was demonstrated publicly at the Library of Congress recently.

The system is a development of R.C.A. laboratories, in cooperation with the Eastman Kodak company and the National Broadcasting company. Basically the operation combines the elements of television with the latest techniques in radio-relaying and high-speed photography. Any languages or line drawings may also be transmitted by this medium.

Future possibilities of Ultrafax are numerous. Homes equipped with television sets could, with proper attachments, print the daily newspaper broadcasts without interrupting the programs being viewed. Military departments would find a ready use for the system. The transmission could be scrambled for secrecy and still handle with only one transmitter, in ten minutes, the peak load of communication that passed through the Pentagon building during a single war day.

New Porcelain Enamel Testing Machine

The department of ceramic engineering has just received a machine for giving an accelerated service test under simulated refrigerator lining conditions, it was announced by Dr. A. I. Andrews, head of the department. The unit consists of a cabinet having space for ten one-foot-square enameled panels which are alternately cooled on one side by a refrigerator then heated on the other side by infra-red lamps in the presence of moisture. Each cycle takes two minutes and in one week, it is estimated that the machine will duplicate conditions in a cold-wall type refrigerator for one year.

R. J. McEvoy, assistant in ceramic engineering, will make these studies as a research problem for an M.S. thesis. The machine was designed and built under the supervision of Mr. L. H. Davidson, project development engineer of the American Central corporation at Connersville, Indiana.

An Ultra-Sensitive Photo Emulsion

Kodak research laboratories have developed a new emulsion for nuclear track plates which is four times as "fast" as the company's previous emulsions of this type.

This emulsion is, in fact, so sensitive, that it must be protected from cosmic rays, which are constantly bombarding the earth. This protection, at present, consists of decreasing the sensitivity by cooling with dry ice to —79° C.

Dr. John Spence, in charge of research on the new emulsion, commented

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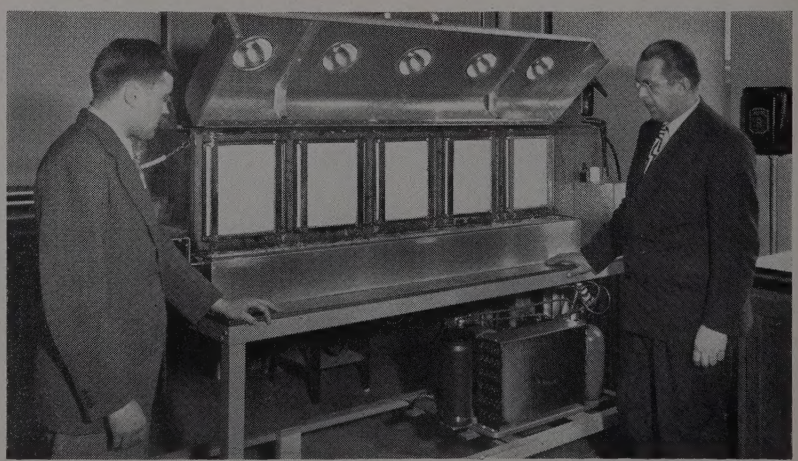

R. J. McEvoy, assistant in Ceramic engineering (left) and L. H. Davidson, of American Central Corporation, inspect the new testing machine for porcelain-enameled steel, which was recently installed in the Cer.E. department.

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Published Eight Times Yearly by the Students of the College of Engineering, University of Illinois

Published eight times during the year (October, November, December, January, February, March, April and May) by the Illini Publishing Company. Entered as second class matter, October 30, 1920, at the post office at Urbana, Illinois, under the Act of March 3, 1879. Office 213 Engineering Hall, Urbana, Illinois. Subscriptions $1.50 per year. Single copy 25 cents. Reprint rights reserved by *The Illinois Technograph.*

Publisher's Representative—Littell Murray-Barnhill, 605 North Michigan Avenue, Chicago 11, Ill. 101 Park Avenue, New York 17, New York.

The Illinois Technograph

Volume 64 **Number 8**

The Tech Presents

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OUR COVER

Dean-Elect William L. Everitt (left) shakes hands with retiring Dean Melvin L. Enger at the first annual All-Engineering Convocation at which they were featured speakers. (Photo by Ralph Zuccarello.)

FRONTISPIECE

J. H. Hagenguth, engineer in charge of General Electric's high-voltage laboratory, stands framed between three huge sphere gaps, preparing to set off a 10,000,000 volt charge of man-made lightning. (Photo courtesy of General Electric.)

The Thermistor, Simple and Rugged

By Leonard Ladof, E.E. '49

Thermistors are made of semi-conductors which are extremely sensitive to slight temperature changes. Variations in temperature as small as one thousandth of a degree centigrade can be measured with the use of a thermistor. These control devices are made from a mixture of metal oxides under very precise procedures, as the resistance of the materials can vary by factors up to a thousand or a million with surprisingly small amounts of certain impurities, with heat treatment, or with methods of making contact.

LEONARD LADOF

Leonard Ladof, a senior in electrical engineering, combines extensive practical experience with theory in his field. He has worked in the radio field since 1936, and served three years in the Navy as a radio technician.

Born in Chicago on May 17, 1913, Len started his college career in 1929 by taking two years of premed. The medical profession's loss was the engineering profession's gain when, after a 15-year absence, he decided to return to school. Len is a member of Sigma Tau, Eta Kappa Nu, Chi Gamma Iota, and A.I.E.E.-I.R.E.

To be generally useful in industry the thermistor should meet these requirements:

1. Mass-produced units should have the same characteristics.
2. Ability to maintain constant characteristics during use; the contact should be permanent and the unit should be chemically inert.
3. The units should be mechanically rugged.
4. The technique of manufacture should be such that the material can be formed into various shapes and sizes.
5. The unit should cover a wide range of resistance, temperature coefficient, and power dissipation.

Production Methods

The methods of production include: melting the semi-conductor, cooling and solidifying, cutting to size and shape; 2) evaporation; 3) heating compressed powders of semi-conductors to a temperature at which they sinter into a strong compact mass and firing on metal powder contacts. While all three processes have been used, the third method has been found to be most generally useful for mass production. This method is similar to that employed in ceramics or in powder metallurgy. At the sintering temperatures the powders re-crystallize and the dimensions shrink by controlled amounts. The powder process makes it possible to mix two or more semi-conducting oxides in varying proportions and obtain a homogeneous and uniform solid. It is thus possible to cover a considerable range of specific resistance and temperature coefficient of resistance with the same system of oxides. By means of the powder process it is possible to make thermistors of a great variety of shapes and sizes to cover a large range of resistances and power handling capacities. The most common forms are beads, rods, discs, washers and flakes.

In designing a thermistor for a specific application, the following characteristics should be considered: 1. Mechanical dimensions including those of the supports; 2. The material from which it is made and its properties. These include the specific resistance and how it varies with temperatures, the specific heat, density, and expansion coefficient; 3. The dissipation constant and power sensitivity. These constants are determined by the area and nature of the surface, the surrounding medium and the thermal conductivity of the supports; 4. The heat capacity which is determined by specific heat, dimensions and density; 5. The time constant. This determines how rapidly the thermistor will cool or heat. If a thermistor is heated above the surrounding temperature and then allowed to cool, its temperature will decrease rapidly at first and then more slowly until it finally reaches ambient temperature. The time constant is the time required for the temperature to fall 63 per cent of the way toward ambient temperature; 6. The maximum permissible power that can be dissipated consistent with good stability and long life, for continuous operation and for surges. This can be computed from the dissipation constant and the maximum permissible temperature rise. This and the resistance-temperature relation determine the maximum decrease resistance.

Even though the thermistor, or thermally sensitive resistor, was discovered only about 15 years ago, industry has already found important and large scale uses for the device.

Some of the uses, as explained in this article, are as time delay devices, protective devices, voltage regulators, thermometers, and temperature control devices, pressure gauges, flowmeters, and detecting elements for very small amounts of radiant power. Thermistors are simple, small, rugged, have a long life, and require little maintenance. Because of these and other desirable properties, thermistors promise to become new circuit elements which will be used extensively in the fields of communications, radio, electrical and thermal instrumentation, and research in physics, chemistry, and biology.

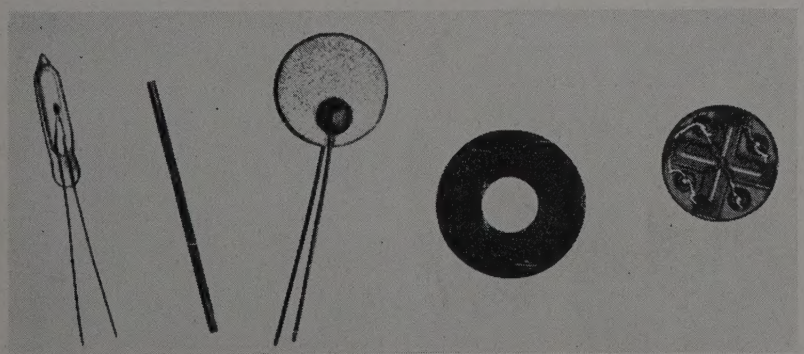

Fig. 1. Thermistors can be manufactured in a variety of forms as (left to right) beads, rods, discs, washers, and flakes. (Photo courtesy of General Electric.)

Properties of Semi-Conductors

As most thermistors are made of semi-conductors it is important to discuss the

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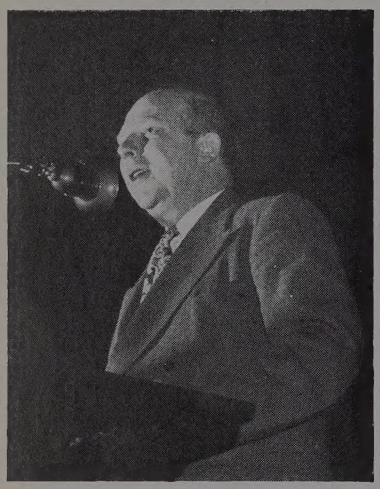
THE CONVOCATION

By Dean R. Felton, C.E. '51



DR. WILLIAM L. EVERITT

"An historic occasion," in the words of Dr. Stoddard was the first annual All-Engineers' Convocation held Friday, April 8, 1949, in the Auditorium.

Sponsored jointly by the Engineering Council and the Illinois Technograph, the convocation was the first assembly of its kind here at the University. The program began with music presented by the First Regimental Band under the direction of Everett D. Kisinger.

Carl W. Falk, president of the Engineering Council, opened the ceremonies with a short introduction and presentation of Dean Melvin L. Enger, head of the College of Engineering and Professor W. L. Everitt, head of the electrical engineering department.

Highlighting the convocation was the announcing of the awards to the winners of the most effective teaching contest by Ed Witort, editor of the Illinois Technograph. Dean Enger made the presentations. The teachers were voted these awards by the junior and senior students of the College of Engineering in a recent poll.

The main address was presented by Dr. George Stoddard, president of the University of Illinois. Dr. Stoddard's address was concerned with the value of effective teaching and stressed that although many teachers were awarded certificates for the most effective teaching, that this by no means detracted any merits from the rest of the instructors. No single method of conducting

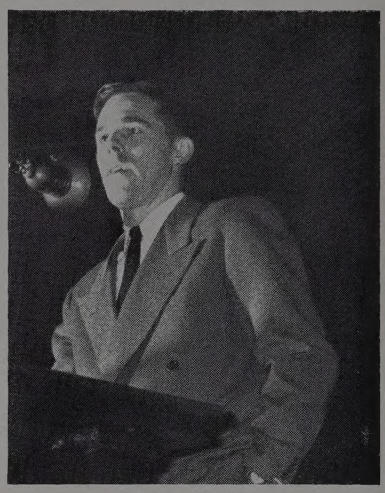
(Continued on page 34)

The Winners

M. Z. Krzywoblocki	Aeronautical
D. G. Carter	Agricultural
R. C. Hay	Agricultural
N. D. Morgan	Architectural
A. W. Allen	Ceramic
R. L. Cook	Ceramic
T. Baron	Chemical
W. E. Hanson	Civil
M. S. Helm	Electrical
S. G. Hall	G.E.D.
E. D. Luke	Mechanical
E. J. Eckel	Metallurgical
W. R. Chedsey	Mining
F. W. Loomis	Physics
G. R. Tape	Physics
O. M. Sidebottom	T. & A. M.

Honorable Mention

H. S. Stillwell	Aeronautical
R. I. Shawl	Agricultural
E. F. Toth	Architectural
F. V. Tooley	Ceramic
W. M. Campbell	Chemical
E. R. Bretscher	Civil
D. E. Glum	Electrical
J. K. Tuthill	Electrical
M. B. Reed	Electrical
L. D. Walker	G.E.D.
B. O. Larson	G.E.D.
D. H. Krans	Mechanical
J. R. Fellows	Mechanical
B. G. Ricketts	Metallurgical
G. B. Clark	Mining
R. A. Becker	Physics
W. E. Black	T. & A. M.



CARL FALK

The sixteen instructors voted "most effective" in the recent contest line up on the Auditorium stage after receiving their awards. The list of winners above reads from right to left. (Convocation photos by Ralph Zuccarello.)

Dr. Everitt: Dean-Elect

By Robert Lawrence, E.Phy, '51

Doctor William Littell Everitt, head of the University of Illinois department of electrical engineering since 1944, will become dean of the College of Engineering next September.

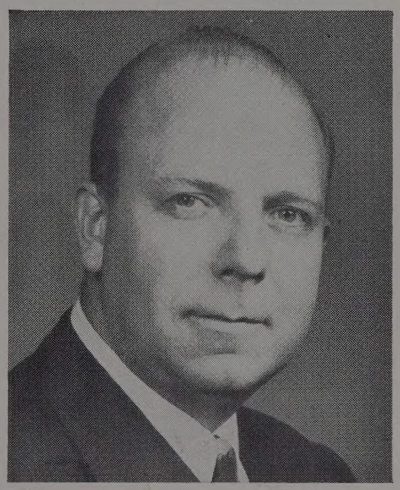
Professor Everitt, widely known as one of America's foremost authorities on electronics, has been appointed by the board of trustees to succeed Dean Melvin L. Enger. Dean Enger has reached the retirement age of 68, and will step down as dean of the college on September 1, 1949.

Dr. Everitt's appointment was influenced by his broad experience of teaching, writing, and pratical work. He served in the U. S. Marine Corps in World War I and joined the Signal Corps reserve in 1922. He received his bachelor degree in electrical engineering from Cornell university the same year. He was also a member of the teaching staff at Cornell from 1920 to 1922.

In the summer of 1920, he was an engineer for the New York Telephone Co., and from 1922 to 1924 was employed as a telephone engineer for the North Electric Manufacturing Co., at Galion, Ohio. The following two years Dr. Everitt was an instructor at the University of Michigan. He obtained his M.S. degree there in 1926 and went to Ohio State university as assistant professor of electrical engineering. He received his doctor's degree there in 1933 and in 1934, was appointed professor of electrical engineering.

Dr. Everitt chose the communications branch of electrical engineering early in his college career. He remained active in the Signal Corps reserve and rose to the rank of major by 1936. He became a member of the communication section of the National Defense Research commission in 1940, and in 1942 obtained a leave of absence from Ohio State university to serve as director of operational research in the office of the chief signal officer, War Department, Washington, D. C.

In carrying out this vital research, Dr. Everitt's principal dealings were with the Air Corps operators from whom he learned the results of the radio and radar equipment supplied by the Signal Corps and determined what improvements were necessary.



WILLIAM LITTELL EVERITT

In recognition of his exceptional performance in this research, Dr. Everitt was presented with the Exceptional Civilian Service Award in May, 1946, by General C. H. Arnold.

The citation on the certificate states, "His outstanding contribution in devising methods and procedures improving Signal Corps equipment and the accompanying instructional literature and improvements in the technical training program resulted in better utilization of radar equipment."

General Arnold emphasized these outstanding duties performed:

"Doctor Everitt developed and improved methods and procedures which accomplished results for the War Department by directing a staff in a thorough investigation in IFF Mark III (identification, friend or foe) and in devising corrective procedures which improved the efficiency in IFF from 76 per cent to 97 per cent; in preparing prototype manuals of preventative maintenance on Signal Corps equipment; in preparing a report on radio wave propagation that showed how each fundamental factor of a radar set effected the maximum range; in developing a new type antenna for use with L. F. Loran; in preparing a handbook 'Fundamentals of Radar A. J.' which furnished basic engineering design information on anti-jamming; in developing a method of measuring the velocity and drag of rockets by use of radar; in devising methods of training radio code operators; and in collaborating with the assistant chief signal officer; Dr. Everitt reviewed the course in electricity at the U. S. Military Academy and recommended fundamental changes in the course that placed stress on electronics."

Dr. Everitt was named to head the electrical engineering department here in 1944, succeeding Professor Ellery P. Paine, and was granted an automatic leave from the University to continue his Army work

Since he came to Illinois, intensive new research programs in electronics have been inaugurated, such as the new vacuum tube research laboratory, and contracts from the Army and Navy departments for resarch work have been made.

The department has increased research on ultrasonics to include detection of infra-red rays and the effect of ultrasonics on nerve tissue and bacteria. Other improvements include a program to give assistance to other departments using electrical measuring instruments, and a revised curriculum for electrical engineers.

Several electrical inventions have been developed by Dr. Everitt, which include a counting relay chain and other automatic telephone equipment, a frequency modulation radio altimeter, and several antenna matching and feeding systems. He has also developed high-power radio amplifier principles.

As a recognized authority on electronics, he has written a number of books. Among them are *Communications Engineering* and *Fundamentals of Radio*. He wrote the section of "Telephone and Telegraphy" in the *Standard Handbook for Electrical Engineers*, and has written and published many articles on radio engineering and communication that have appeared in various technical publications.

Dr. Everitt has been active in several engineering societies and organizations. He has been president and director of the Institute of Radio Engineers and has given lectures before more than forty sections of the Institute. He has been a member of the electronics committee of the joint Research and Development Board of the National Military Estab-

(Continued on page 34)

I SEE YA TALKIN'

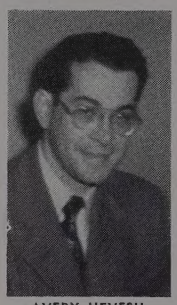
By Avery Hevesh, E.E. '49

The concept of "voice writing" is not a new one. Many of us are familiar with the complex wave trace representing speech visually on the screen of an oscilloscope. Motion picture sound tracks portray the characteristics of voice or music by a pattern of light and dark areas on film. These methods and several others achieve the display of what may be called "visible sound." On many occasions it may be desirable to analyze the sound in order to learn more about the complicated combination of single frequencies that blend to form audible sensations.

Usually, the interest lies in splitting sound into its separate fundamental frequencies and their attendant harmonic frequencies. Unfortunately, none of the sound patterns produced by the methods mentioned above lend themselves to easy analysis. Harmonic analysis in the laboratory may be done by picking out single frequencies from a steady state complex wave. Separation is accomplished by sending the wave through a series of narrow filters, each of which selects a single frequency or a small group of adjacent frequencies. Graphical methods of Fourier analysis may also be applied to a complex wave form, but the mathematical labor is usually discouraging when speech is concerned. In any event, conventional methods of analysis are found to be impractical due to the equipment or effort involved.

Here is presented a survey of the historical development and results achieved with a new device which started off as a research instrument for sound analysis. The device finds one of its most important uses in the training of the deaf to "read" sound and learn to speak effectively—some for the first time.

Still another limitation that may be found is the clear presentation of all the dimensions of speech. While frequency and relative amplitude may be shown by some of the analyzing methods, the third variable, a chronological time order, is either obscured by the display or neglected entirely. The time dimension is supplied by the memory in aural reception, and to some extent in visual discrimination. In the latter it is commonly known as persistence of vision. It has been found, however, that visual analysis is much easier when the time sequence is included. Since speech energy varies with frequency and time, three-dimensional models may be constructed which correctly show the energy distribution as a function of its two variables. All three basic dimensions are required in order to learn new facts in the study of sound; but it would be quite inconvenient to work with solid models. Therefore, one of the problems related to the sound display is that of representing three independent variables on a plane surface. The new process of visible sound, using the sound spectrograph, accomplishes this successfully.



AVERY HEVESH

Avery Hevesh was born in Chicago, but soon moved to New York where he received his pre-college training.

Avery enrolled in L.A.S. when he arrived here at Illinois, but later switched to electrical engineering. The change seems to have agreed with him, for he attained membership in Tau Beta Pi, Sigma Tau, Eta Kappa Nu, and joined the A.I.E.E.-I.R.E.

After completing the communication option this June, Avery is planning to work for a while in development work before starting graduate school.

Development of the Spectrograph

From studies on speech distortion in telephone circuits, it was realized at the Bell Telephone Laboratories in New York that no device adequately fulfilled the requirements of sound analysis. The first model of a sound spectrograph, designed to overcome the aforementioned disadvantages, was built at Bell and produced patterns that were crude—by present standards of detail—but the initial step had been made. Several years of steady improvement in the device followed. Further refinements were made at Haskins Laboratories in New York in connection with the development of reading machines for the blind. The patterns produced by the latest spectrographs simplify sound analysis considerably and introduce some entirely new applications.

It was appreciated rather early during these developments that the methods of "reading" sound would be of considerable interest to the deaf, since the spectrograph would present sound visually. "Voice writing" is an apt description of the process of learning to recognize the visual counterparts of spoken words and sentences.

Thus, there are two fields of interest that merge in the study of visible speech. The scientist, who is interested in sound anaylsis, is concerned with the detailed patterns that represent speech or other audible sound. Those interested in the problems of the deaf are concerned with the modulations of speech that carry intelligence—that is, readability of the patterns. Accordingly, two general types of spectrographs have grown out of the basic model. One deals with permanently recorded pat-

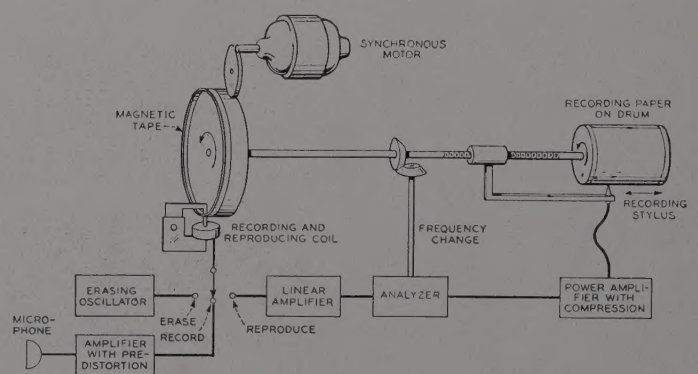


Fig. 1. The Bell spectrograph records sound on a magnetic tape drum and transfers it, separated into frequency bands, to a sensitized paper for a permanent record. (Courtesy of Bell Telephone laboratories.)

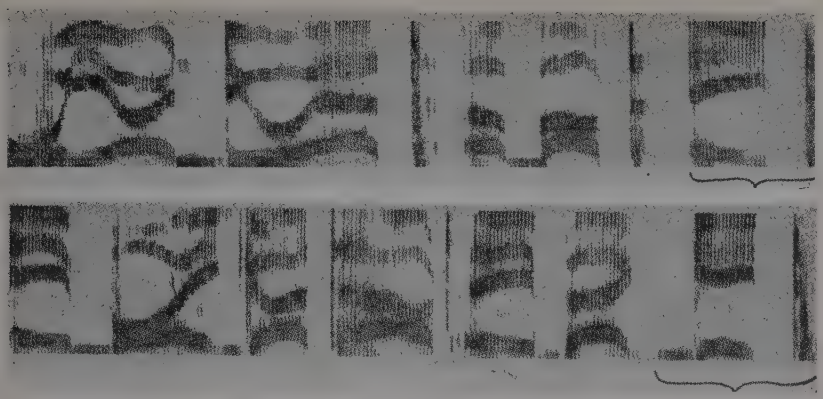


Fig. 2. Two spectrographs of ordinary speech made on recent machines are shown above. The sentence recorded on the upper strip is, "We are due at about eight,." and on the lower, "A boy got out a back gate." The words "eight" and "gate" are bracketed for comparison. (Courtesy of Bell laboratories.)

terns suitable for analysis and study; the other provides transient patterns suitable for visual hearing.

Permanent Spectrograms

Figure 1 represents a block diagram of the basic Bell spectrograph for producing permanent patterns. Two spectrograms made with recent machines are shown in Figure 2. Two of the variables are represented by the coordinate axes. Frequency is shown along the vertical axis with the high frequencies at the top and the low frequencies at the bottom. Time sequence is indicated along the horizontal axis and proceeds from left to right. The third variable, intensity, is shown by the varying shades of gray. Even at first glance the pattern resolves itself into a form that is readily retainable in the memory. The dark bands that appear on the spectrograms are regions of mouth cavity resonance.

In the Bell instrument the speech is recorded on a rotating loop of magnetic tape. Transfer of the sound from there to the sensitive paper is a delicate process that involves synchronization. The frequency axis on the recording drum is horizontal; and since the time axis is around the circumference, a point on the magnetic tape corresponds to a point on the time axis around the drum. The magnetic tape is constantly rotated to give a repeated reproduction of the initial speech. The sound is then separated into 60 different wave bands by the analyzer, and each band is fed into the power amplifier. For one revolution of the magnetic tape only one wave band actuates the recording stylus. For the next revolution the stylus moves horizontally and records the impulses in the next wave band. This process continued until the whole range of frequencies is covered.

The Haskins device is almost identical except that the record tape is replaced by a single-groove record of the desired sound and a photographic film is used on the recording drum. Here again, the sound to be pictured is played repeatedly through the scanning filter, which moves slowly across the frequency spectrum from 100 cycles to about 4,000 cycles. A high-intensity electron spot is produced on the screen of a small cathode-ray tube where an optical system focuses it upon photographic film in a light-tight drum. The cathode-ray tube is actuated by the sound which passes through the analyzer, and the intensity-modulated electron spot produces upon the film a progressive spectrogram as each sweep cycle is recorded.

The advantage of using film on the recording drum is that a greater range of intensity variation is possible. The maximum and minimum power levels of normal speech are on the order of 100,000 : 1. The amplifiers used with the Bell instrument cover most of this range, but the whole recording system is limited by the 12 db. sensitivity of the recording paper. There is a much wider latitude to the density range of film, and levels up to 50 or 60 db. are not uncommon. Thus, better dynamic range in the film spectrograph leads to more faithful reproduction of sound patterns. However, even with the wide sensitivity range, some signal compression is necessary to reduce the effect of the excessive contrast that appears in human speech.

The two spectrograms shown in Figure 2 were produced by a unit using wide band-pass filters to reduce unnecessary detail and raise the readability level, or "discrimination index." Each word stands almost as a unit in itself, since single-syllable combinations were used primarily. Notice the similarity in the words "eight" and "gate" in the respective patterns. The visual pictures of these two words are almost identical except for the low frequency resonance bar (the dark band) at the beginning of the word "gate." The vertical striations are caused by beats between adjacent harmonics.

To show still more conclusively the ease of recognition, Figure 3 is included. Here, the same sentence was spoken by four subjects from different regional areas. It is apparent that the speech similarities are greater than the differences. Although no two individuals have identical v o i c e characteristics, visible speech as considered here does not emphasize the dissimilarities. The variation of pattern shapes for different people has been described in much the same way as the variation of handwriting among individuals.

The spectrogram patterns used for illustration here have been chosen to represent one of the most complex of sounds—that of human speech. Yet the adaptability of the equipment to other types of signals is quite feasable and many studies have been made of sounds other than speech. Such varied sounds as those of bird songs, machinery, noise, and even snoring are exposed by spectrographic study.

Spectrograph work has made possible the reproduction of many sounds

(Continued on page 30)

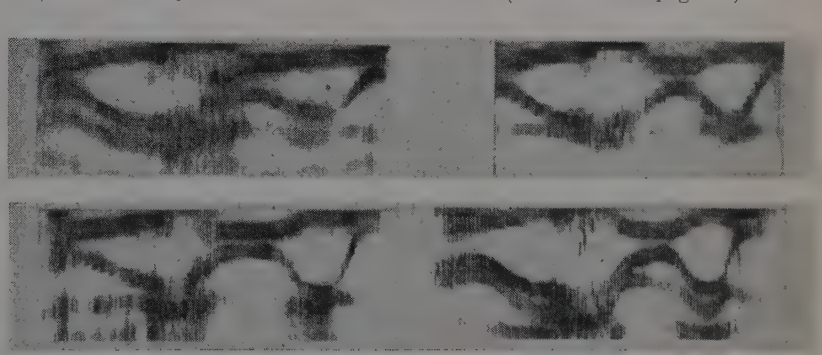


Fig. 3. Shown above are four spectrographs of the phrase, "We are here," spoken by subjects from four regions: upper left, general American; upper right, English; lower left, eastern American; lower right, southern American. (Courtesy of Bell laboratories.)

New Headquarters for Chem Engineers

By Art Dreshfield, Ch.E. '51

The opening of the new chemical and chemical engineering building this fall will mark another major addition to the expanding engineering facilities on the Urbana campus.

Started in September, 1947, the building is now practically completed and ready for the installation of equipment, most of which will be moved in and assembled during this summer. By the beginning of the fall semester, the chemical engineering department will move in, and, for the first time, will be housed in a building designed for their needs.

This building has five floors plus a basement, sub-basement, and penthouse, and contains over 100,000 square feet of floor space. An elevator transverses the entire height of the structure, except the penthouse, and a tunnel connects the sub-basement with Noyes laboratory and Chemistry annex.

Unit Operations Lab

One of the outstanding features of the building is the unit operations laboratory, which will replace the present inadequate facilities in Noyes laboratory. A large amount of equipment now scattered in several places will be installed here, and much new equipment is now on order.

This laboratory will have 3,600 square feet of floor space, and will extend through three stories. Mezzanines of iron grilling, five feet wide, will run completely around the laboratory at nine-foot intervals, making three additional operating levels besides the main floor. Thus the entire 40 feet of headroom will be easily available for those without heart trouble.

Adjoining this laboratory and the elevator shaft will be another shaft which will extend to the top of the building. It will give a space over 70 feet high to be used for distillation columns or other unusually tall equipment.

The laboratory will be used primarily by students in the laboratory courses in unit operations—Ch. E. 372 and 374, but it will also be available to others who wish to make use of some of the equipment or to take advantage of the high clearance.

One of the completely new items in this laboratory is a single effect evaporator which is 20 feet long, 11 feet wide, and 12 feet high. It has vertical tubes and a 20-inch diameter tank, built to be operated at pressures ranging from 10 pounds vacuum to 15 pounds gauge; it can be operated as a forced circulation evaporator or as a natural circulation long-tube evaporation unit. With the pumps by-passed, it can also be used as a rising film or a falling film unit, or as a flash type evaporator.

All motors on it will be explosion proof, so that it can be used with a wide variety of substances under greatly varying conditions. With it, students will be able to study heat transfer and evaporation and processes in detail.

Another new piece of equipment is an 11-foot-high, six plate distillation column. It is a foot in diameter and made of bronze. Operating at pressures up to 100 pounds gauge, it, too, is very versatile, and will be useful for studying distillation processes with various liquids and at several capacities.

Two other new units are also planned for this laboratory. One is a stainless steel rotary filter, 18 inches in diameter, with a 12-inch face. It will replace the old Oliver filter which is now being used. The second is to be a rotary tunnel drier, a piece of equipment looking and operating somewhat like a rotary kiln, but at much lower temperatures.

Besides this, there will, of course, be much other equipment. Thickeners, driers mixers, and all the usual equipment found in a unit operations laboratory will make this one very complete.

An overhead crane running the full length of the laboratory and extra-large doors which open directly onto a driveway will make the task of installing and moving equipment much easier.

Other Features

Across the hall from the unit operations laboratory will be the crushing and grinding room. While nothing new has been ordered, it will have a large stock of equipment. This includes ball mills, disc pulverizers, hammer mills, a jaw crusher, roll crusher, gyrating crusher, shaker screens, and other items which will be capable of processing stones and powders ranging from three-inch diameters down to pigment sizes.

Separate electric motors will be mounted on each piece of equipment, eliminating much of the noise and trouble formerly caused by the shaft and belt drives. Locating all this equipment in a separate room will eliminate abrasive dusts from the shops and from other laboratories where it could damage bearings and machinery.

A high pressure laboratory on the first floor will contain many new innovations. A pit six feet below the floor level of the main laboratory is provided for somewhat hazardous equipment to keep it off the main operating level; and there will be new and old safety cubicles made of quarter-inch boiler plate.

Two new compressors will be placed in this laboratory. One will be a five-

(Continued on page 24)

The new Chemistry and Chemical Engineering building at the corner of Matthews and California streets is nearing completion. Photo by Al Augustyn.)

Room 50, the big basement motor-generator laboratory in the new E. E. building, is shown above. (Photo by Jack Chandler.)

E. E. Building Dedication

By Luther Peterson, E.E. '51

At last! The formal dedication of the new electrical engineering building will take place on May 20, 1949.

After many years of planning, the new electrical engineering building will officially become part of the engineering campus. Extensive and interesting programs are planned for the three-day dedication with alumni as guests.

To make this dedication a memorable and educational affair, several talks on various scientific topics, pertaining mostly to the field of electrical engineering, will be given. These talks and discussions will be divided between the two main interests of the dedication—the symposium, and the general sessions.

The symposium, whose theme is "Expanding Frontiers in Engineering," will consist of four sessions. In these sessions, timely topics such as "electron and ion dynamics," "semi-conductors," and "statistical problems in electrical engineering" will be discussed.

The general sessions will deal mainly with the training of electrical engineers. To cover this subject adequately it will be divided into three main topics—the "electrical engineering curriculum," "post graduate training in industry," and "the approach to a research problem."

In order that these subjects be properly discussed, well known speakers from General Electric, Massachusetts Institute of Technology, Carnegie Tech, Nela Park Laboratory, National Bureau of Standards, RCA Laboratory, Bell Laboratory, and of course, representatives from our own University of Illinois will be present; in fact, Mr. E. S. Lee, president of the A.I.E.E., will be the keynote luncheon speaker. To round out such a splendid program, President G. D. Stoddard will speak at the dedication ceremony and the genial department head, Professor W. E. Everitt, will close the celebration.

Interspersed among these various events will be very important dinners and luncheons.

It might be worthwhile noting that the engineering students will be dismissed from their E. E. classes. Of course, the idea of no classes might make some students feel "blue," but due to the fact that a dedication is held only once in the lifetime of a building, the E. E. department feels that lack of instruction for a few days won't be too disastrous. On the other hand, the E. E. department has contemplated holding a few classes for a few engineers to display the "brilliance" that has befuddled the instructors for years.

Included in the program is the inevitable tour of the new building—to give the College of Engineering a chance to "expand its chest."

The New Internal Combustion Laboratory

By Art Dreshfield
Ch.E. '51

Next fall another north campus building will be ready for use by the engineering students. It is the new mechanical engineering building at the corner of Green and Mathews streets. This new unit will contain several laboratories in addition to classrooms and offices. A good part of it will be ready for the 1949-50 school year, and the rest should be completed in time for use in the fall of 1950. Of special interest to all mechanical engineers is the new internal combustion engine laboratory which will occupy part of this building.

This laboratory will be of approximately the same size as the present engines laboratory, about 100 feet long and 40 feet wide. In it will be much new equipment. It will contain five new 150 - horsepower dynamometers, which can be run at speeds up to 6,000 r.p.m. Five new motors are on order which will be connected to these. One is an International Harvester U.D.-6 Diesel; another a General Motors two-cycle, three - cylinder motor; a six - cylinder Chevrolet motor; a Kettering V-8 Oldsmobile motor; and a new Plymouth motor. All of these are 1949 models, so students will be using the latest equipment available.

Two 150-horsepower motoring dynamometers will also be installed, one running up to 3,500 r.p.m. and having a Walker-Shaw test engine attached, while the other will be used for testing centrifugal superchargers.

There will also be much equipment for testing motor accessories and parts. Tests will be made on magnetos and generators, on water, oil, and fuel pumps, and on carburetors and carburetor flow.

Two other large installations will also be in the main laboratory. One is a two-cylinder Atlas Imperial engine equipped with a Prony brake. This was formerly in the old mechanical engineering laboratory, but will be moved. The other is a gas turbine, made at the University from a turbosupercharger and a turbo-jet unit. Eventually a more conventional turbine may be bought which will replace this.

All of this apparatus is located in the main laboratory, where it will be used by undergraduate students taking courses in internal combustion engines. This will not replace the present engines laboratory, which contains mostly steam equipment, but will serve to augment it and to make more facilities available to student engineers.

(Continued on page 28)

In This Corner... NAVY PIER

St. Pat Visits Navy Pier

By Robert Lessin, M.E. '51

On March 18, 1949, in the Grand Ballroom of the Edgewater Beach hotel, the Chicago branch of the University held its first annual St. Pat's Ball. Sponsored by the newly formed Engineering Council, the highlight of the evening was presentation of the *R. P. Hoelscher* Award. The award is given to the engineering society that contributes the outstanding achievement of the year. This year the award went to the Penalears through the efforts of Frank Hoelterhoff for designing the Council emblem.

The original dance was established in 1934 as an annual affair for the engineeers at the Urbana campus. This dance is patterned, in part, after the annual affair held Downstate.

Approximately 250 couples danced till one o'clock to the danceable music of Eddie James and his orchestra. Some of the features of the dance were the Grand March during the latter part of the evening and the introduction of the heads of the various engineering societies. The bids—a shamrock with a slide rule center—were unusual and aroused interest from all who were present.

The general chairman of the ball was Roy Peterson, C.E. '51. M. C. for the evening was Gordon Knudson, M.E. '51, who had much to do with the original formation of the council.

It is hoped, in the years to come, that the dance will be presented at the climax of an engineering show held here at Navy Pier.

Gordon Knudson presents the R. P. Hoelscher award to Richard Welden of the Penalears.

PIER PERSONALITIES

By John Fijolek, Eng. Phys. '51

DEAN R. P. HOELSCHER

As every engineer at the Pier knows, Room 184 near the east end is one of the control points in his college career. When he wishes to change his curriculum, to alter his records in any way or to explain why so many D's slipped in among those more pleasing first three letters of the alphabet, he knows a trip to room 184 is almost inevitable. But, besides his records, he knows this room houses one of Navy Pier's leading personalities, Dean Randolph P. Hoelscher, associate dean of engineering science and professor of general engineering drawing.

Not every Pier engineer has seen or met Dean Hoelscher but they have all heard of him. Due to his many duties and the great number of engineering students present at the Pier, only the last has been possible. He is readily accessible to all who have business requiring his personal attention. To those, who by their past conduct required corrective advice, certainly he appeared formidable; but to others who came seeking relief from excessive burdens and who needed support for student projects and activities, he has been an able and willing counsellor. His efforts have enabled the Pier engineering societies to grow and function more efficiently.

Before he achieved his present position of trust and responsibility, however, he had origins elsewhere. Randolph Philip Hoelscher was born in Evansville, Indiana, on December 12, 1890. He received his B.S. in civil engineering at Purdue in 1912, his M.S. in civil engineering at the University of Illinois in 1927 and his civil engineering from Purdue in 1929. He has been a member of the faculty since 1918 in various capacities at the University of Illinois, where he came after two years as an instructor of physics at Baldwin Wallace college in Berea, Ohio. Before this, he had spent four years with George L. Mesker and company of Evansville, Indiana, as a structural engineer.

In addition to his teaching and administrative work, he has become well-known in engineering and educational circles through his authorship of technical textbooks, notably "Engineering Drawing," "Essentials of Engineering Drafting," "Teaching Mechanical Drawing," "Graphic Aids in Engineering Computation" and "Industrial Production Illustration."

He has participated actively in various

RANDOLPH HOELSCHER

organizations through membership in the Kiwanis, ASCE, ASME, AIEE, Tau Beta Pi and Triangle. He has been president of several of these organizations, is now chairman of the committee on commencement at the Urbana campus as well as secretary of the University Senate. In addition to being a member of several other important councils and committees, he is a licensed structural engineer in the state of Illinois. In the past year, the Pier branch of Phi Eta Sigma, recognizing his talents and popularity among the students, elected him to honorary membership in that organization.

All of the above facts added to the personal information that he married in 1914 and has two children, show that the head of the engineering college at Navy Pier is a likeable, approachable human being and truly an outstanding Pier personality.

ENGINEERING SOCIETIES

By Bob King, C.E. '51

A.S.C.E.

There were 150 members and prospective members present at the chapter's meeting on February 22 . The topic of the meeting was "Summer Survey Camp" for '49. Dean Hoelscher was the guest speaker and movies taken at the summer camp last year were shown. The Dean discussed the camp in general and announced that a scholarship was to be awarded by the Civil Engineering society to one of its members for use at camp this summer.

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Undercover at . . . GALESBURG

MR. HOWARD C. NELSON

By Robert D. Giffrow, E.E. '52

One of the men who was instrumental in launching a successful engineering department at this Galesburg division is our drawing instructor, Mr. Howard C. Nelson.

Since the initiation of the division, Mr. Nelson has become a familiar figure to the engineering students, most of whom met him either in the descriptive geometry or mechanics of machinery classes.

Mr. Nelson's position as a competent instructor is fortified by several extra years of schooling. That he was interested in obtaining a diversified education was illustrated by the fact that he attended several colleges while intermittently teaching. He was a student at Illinois Wesleyan university, Illinois State Normal, and finally the University of Wisconsin, from which he receiv his B.S. in industrial education. His formal education did not stop there,

HOWARD C. NELSON

however, for he then attended the University of Illinois, where he received his M.S. degree—also in industrial education.

As a result of this keen interest in education he has written three books on woodworking projects and mechanical drawing. In his attempts to convey his ideas to the student he has written innumerable articles for various magazines.

Before arriving here in the fall of 1946, Mr. Nelson was an instructor at the LaSalle-Peru and Monmouth high schools and Monmouth college for a total of 29 years. These years of experience have made him a valuable asset to the University, for they have enabled him to make a clear presentation of engineering curriculum to the student.

Proof that Mr. Nelson's knowledge and abilities have not gone unnoticed is found in the fact that he is listed in *Who's Who in American Education.* He is also a member of two honorary educational societies—Phi Delta Kappa and Kappa Delta Pi.

His earnest ability to help the student, coupled with his warm personality, has surely made Mr. Nelson a man that every engineer on the Galesburg campus should know.

Curriculum Planning Made Easy

By Roger Franzen, G.E. '52

The problem of planning what courses to take has been greatly simplified for engineering students here by the development of a chart called the flow sheet.

The flow sheet is a blue print designed to serve as a guide to engineering students in determining what courses lie ahead and what the prerequisites to these courses are. In addition, by using the legend in the lower left hand corner of the flow sheet, engineering students are able to keep a record of the courses that they have completed and to keep an account of their grades and credit hours.

The flow sheet was formulated at the Galesburg campus by Professor Fred Trezise, chairman of engineering sciences at the division. They have been placed in the possession of all Galesburg engineering students and their advisers, and are expected to appear on the Urbana campus before long.

The flow sheet has a unique feature, in that it consists of only one paper which gives any desired information at a glance, thus eliminating the bother of thumbing through the University catalog. A series of evenly distributed squares along with arrows and dotted lines conveys the information contained in the sheet. Each square is labeled to represent a specific course.

A directed arrow from one square to another indicates that the square from which the arrow originated is a prerequisite to the square (course) to which the arrow is pointing. For instance the square representing Rhetoric 101 has an arrow leading from it to the square representing Rhetoric 102, indicating that Rhethoric 101 is a prerequisite to Rhetoric 102.

A dash line connecting two squares indicates that a prerequisite can be taken concurrently with the course. For example, the dash line between Math 132 and Physics 103 indicates that Math 132 is a prerequisite for Physics 103 and that it can be taken concurrently.

Mr. Trezise has adapted a flow sheet to fit the needs of every engineering student at Illinois, regardless of the type of engineering he is studying. Each curriculum has been divided into various options and a flow sheet has been prepared for each specific option. For example, the flow sheet for "Mechanical Engineering-Production Option" would differ in some ways from the "Mechanical Engineering-Design Option" sheet.

Since most students have difficulty in understanding curriculum requirements as set down by the University catalog, and since there is a possibility that advisers may mistakingly encourage students to take unrelated courses, it seems that the flow sheet could be valuable as a guide to everyone concerned.

Its graphic illustration of prerequisites and requirements leaves little chance for uncertainty.

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"Lumber Men Go to School"

By Jack Keefner, E.E. '52

A temporary twist has been added to the curriculum at the Galesburg campus in the form is a lumber dealers' short course, sponsored by the Illinois Lumber and Material Dealers' Association in cooperation with the extension division, University of Illinois. The students who attend this course are lumber dealers, or prospective lumber dealers from Illinois and adjacent states, all of whom have had experience in their field.

These lumber men are ideal students. Lively discussions follow each lecture, indicating the desire of the men to learn everything the course has to offer. Their dividends, anything that will make their yards run more smoothly or make the boss raise an eyebrow of approval, will be realized more quickly than those of the regular college student. Also, an honest desire to help ease present day conditions is a major factor.

(Continued on page 38)

The Engineering Honoraries and Societies

By Bill Soderstrum, Cer.E. '52

A.S.A.E.

Our representatives on the farm front give a most amazing financial report. The balance reported at the February 28 meeting was $500. A large part of this came from the Farm and Home lunch stand profit.

At the February meeting the members of A.S.A.E. also selected committees for the promotion of "George Mahoney for St. Pat." If you have been keeping up the events on the Engineering campus, you should know how successful that committee was.

At their March 28 meeting, the agriculture engineers listened to Mr. Louis B. Howard, professor of food technology. Mr. Howard addressed the group on "What is Food Engineering?"

Officers for the spring semester are William Fletcher, president; Richard Sharp, vice president; Warren Harris, secretary; and Robert Camp, corresponding secretary.

A.I.E.E.-I.R.E.

Looking forward to that job after graduation, the electrical engineers received with enthusiasm the talk given by Mr. C. M. Henderson, member of the General Motors college relations staff, at the March 2 meeting of A.I.E.E.-I.R.E.

Business conducted at this meeting included the election of Norton Bell as corresponding secretary for I.R.E. and Dick Wurzburger as Engineering Council representative.

During the month of March the A.I.E.E. sponsored a student opinion poll. The subject of the poll was "too many class hours for the amount of credit given." Results are not yet available.

At the March 31 meeting, Mr. Howard L. Clark, development engineer for General Electric, was the guest speaker. Mr. Clark spoke on the type of work done in the general engineering and consulting laroratory of General Electric in Chicago.

KERAMOS

Keramos, the ceramic engineering honorary society, elected 17 students to membership. Of the 17, 10 were juniors, one a sophomore, and six were graduate students. These men were entertained at a smoker held on April 17. Pledge week for the neophytes was observed from April 11 to April 14. These pledges were finally initiated on April 21.

CHI EPSILON

The new officers have been chosen for Chi Epsilon. At a meeting held in Engineering Hall on March 16, 1949. This society elected Ronald D. Collins, president; John D. Goodell, vice president; Philip Sikes, treasurer; Floyd E. Brown, secretary; and William B. Sands, corresponding secretary.

At this time Prof. Ellis Danner gave a talk on "Future Highway Development in Illinois." Petitions were also approved at this time for establishing chapters at the University of Connecticut, the University of Virginia, and the University of Michigan. Refreshments were served after the meeting.

A smoker, held on March 28, acquainted the members with the new pledges and vice versa. At an initiation banquet held in the early part of April, the acceptable pledges were taken into the fraternity.

M.I.S.

Dr. A. B. Cleaves addressed some 75 members and guests of the Mineral Industries Society on "Geological Engineering on the Pennsylvania Turnpike" at the February 16 meeting of M.I.S. Dr. Cleaves of Washington University worked on the Pennsylvania Turnpike as a geological engineer. He is also a mining engineer.

At the March 9 meeting, Mr. Paul Wier spoke on "The Young Engineer and the Coal Industry." Mr. Weir of Penn State has his own coal company in Chicago. The highlight of this meeting was the presentation of a watch to George Eadie by Mr. Weir. Mr. Weir is president of the Old Timers club which each year presents a watch to the outstanding graduate in mining engineering.

The meeting for this month will be replaced by the annual Spring Picnic.

C.I.E.

People seem to be the same all over the world. The Chinese are just as much influenced by a pretty girl as any American. Proof of this lies in the fact that Miss Shook-May Young, the only woman member of the Chinese Institute of Engineers at Urbana, was elected its president for the spring semester.

The election was held at a meeting in the University YMCA on February 19. Speakers at this meeting and their topics were as follows: Mr. M. T. Chang, "Railway Yard"; Mr. T. S. Yen, "Ceramic Industry"; and Mr. H. C. Hu, "Vacuum Tube." Each one of the speakers is working for his doctor of philosophy degree in his particular field.

Sixteen of the 80 members received their master of science degrees at the end of last semester. They are Mr. Chang, Chi-Shih; Mr. Pang, Dick-Noe; Mr. Chen, Chia-Yung; Mr. Chai, Chang-Ba; Mr. Jean, Jia-Hung; Mr. Lee, Dah-Hsuan, Mr. Li, Kou-Jun; Mr. Lee, Zur-Kong; Mr. Pan, Sai-Lung; Mr. Sun, King-Sang; Mr. Liu, Chen-Hua; Mr. Mei, Hsien-Hao; Mr. Tu, Yu-Ching; Mr. Chao, Mein; Mr. Wang, Ronald Hung-Chao; and Mr. Chin, Te-Ning.

I.E.S.

Mr. G. K. Hardaire, manager of commercial sales for the Public Service Co. of Northern Illinois, was the guest speaker at a joint meeting of I.E.S., and the A.I.E.E.-I.R.E. in Gregory Hall on March 9.

Mr. Hardaire, a past president of I.E.S., spoke on "What the Young Engineer Should Expect After Graduation." He also presented the local chapter a charter as an official acceptance of the student chapter into the national I.E.S.

At the meeting of March 30, Mr. Knudstrup, chief commercial engineer for the Electro Manufacturing Co. in Washington, D. C., spoke on "Design and Application of Fluorescent Lighting Equipment." Other business conducted during this past semester included nomination and election of officers for next semester and the annual picnic.

Most of the I.E.S. members went to Chicago to attend the third International Lighting Exposition and Conference at the Stevens Hotel on April 1.

Greatness stands upon a precipice, and if prosperity carries a man ever so little beyond his poise, it overbears and dashes him to pieces.—Seneca.

Introducing . . .

By Henry Kahn, Ch.E. '50
and Alfreda Mallorey, M.E. '52

Chalmers W. Sherwin

Chalmers W. Sherwin, now associate professor of physics, came to the University of Illinois two and a half years ago after completing graduate work at the University of Chicago.

During the war, Mr. Sherwin spent five years working with radar at M.I.T., devoting most of his attention to radar displays, especially the ones

CHALMERS W. SHERWIN

used to conduct blind landings. After leaving M.I.T., he spent a few months working at Columbia university and at the present time he can be found working in his office on the top floor of the Physics building.

Having done work with electronics and radiation, Mr. Sherwin became interested in a new particle, the neutrino, believed to be present in the nucleus of the atom. When asked how the presence of the neutrino was determined, he explained, "It is as simple to understand as the sophomore physics problem, 'what happens when a bullet is fired from a gun?' " The bullet is hurled into space with a force equal and opposite to the recoil of the gun. Now, suppose there was a second bullet. This bullet would represent the neutrino and would be fired with the first. It would disrupt the forces so that the force between the gun and the first bullet would no longer be in a straight line. Mr. Sherwin's extensive research proved that the pull between an atom and an electron is not in a straight line; therefore the presence of a third force, caused by the neutrino, is necessary.

When not working at his office or the class room, one can find him at home with his wife and four daughters reading, especially books on philosophy and religion; experimenting with photography; or studying his newest semantics discovery.

MRS. M. C. BARBER

"I have the best job at the University," Mrs. Barber, secretary of the architecture department, remarked; and that is, to say the least, unique.

Mrs. Barber was born in 1906 at Nokomis, Illinois. In 1920 she moved to Urbana. Soon after her marriage in 1927, she started her career in the architecture department as a clerk-stenographer to L. H. Province, who was succeeded by Dr. T. C. Bannister as head of the department last September.

The connotation of secretary of the architectural department is certainly not comprehensive enough to cover all the duties of Mrs. Barber. In 1932, she started a system of graduate records, which are used for the placement of students. She also helps in the publishing of an annual newsletter which is sent to former students, among whom are famous men like Charles Luckman, president of Lever Brothers, and Max Abramovitz, United Nations architect.

In addition to her official duties Mrs. Barber has been very active socially. She has served on the clerical council and the non-academic social committee. She is also serving as treasurer of the Civil Employees Council to which she has been elected for the third time. Another one of her interests has been non-academic civil service classification.

MRS. M. C. BARBER

VOCABULARY CLINIC

Remember, you won't be able to use these words until after you have consulted the dictionary for their pronounciation. From the group of words at the right, select one whose meaning closely resembles the word on the left. Answers will be found on page 38.

1. ASCETIC—(a) austere, (b) ill at ease, (c) uncouthness, (d) sickly
2. PROLIXITY—(a) ambition, (b) overabundance, (c) precise, (d) redundancy
3. CLEMENCY—(a) kindness, (b) rigor, (c) exoneration, (d) control
4. SUPERFLUITY—(a) paucity, (b) freely flowing, (c) excess, (d) indulgence
5. PICAYUNE—(a) Dixie, (b) type of candy, (c) of little value, (d) large
6. IMPORTUNATE—(a) unlucky, (b) chaste, (c) impotent, (d) troublesome
7. COMPLICITY—(a) inspiration, (b) complexity, (c) tact, (d) silence
8. ABATOIR—(a) slaughterhouse, (b) monastery, (c) pigpen, (d) brewery
9. PROPENSITY—(a) inclination, (b) hatred, (c) wealth, (d) coy
10. NOMENCLATURE—(a) equipment, (b) type of architecture, (e) probability, (d) classification of names
11. DOGMATIC—(a) brazen, (b) meek, (c) dictatorial, (d) slow-moving
12. ASSUAGE—(a) to seek, (b) to satisfy, (c) to open, (d) to kill
13. TRANSCENDING—(a) surpassing, (b) going across, (c) flowing (d) traveling
14. APPELLATION—(a) star, (b) name, (c) beauty, (d) foil fencing
15. ENNERVATE—(a) to unnerve, (b) to dispose of (c) to invigorate (d) to enforce

EDWIN A. WITORT
Editor

•

PHILLIP B. DOLL
Assoc. Editor

the Illinois Technograph

Fore and Aft . . .

As the present school year nears completion, it might be well to look over the past eight or nine months' activities of the "north side of the campus." While reminiscing, our thoughts will naturally stray to the '49-'50 term, and perhaps by applying a bit of "engineering analysis," we will arrive at some interesting predictions concerning next year's activities.

The professional and honorary societies affect the majority of engineering students and, as a result, are responsible for consuming more of our time than any other one organization on the campus. Practically every engineering society was successful in their undertakings this year. Membership boomed, and attendance at meetings, smokers, and other events was well above average. Several societies reached the highest membership in their history. This success was probably due to the members' realization of the benefits received by participation and to the societies' success in setting up an interesting and educational program for the year.

At present, an investigation is underway to determine the feasibility of having the dean's office coordinate the meeting dates of all engineering societies. If this plan is put into effect it should prove to be very beneficial. Engineering Council business will be able to progress at a rapid pace and society programs of general interest will not conflict with meetings of other societies.

St. Pat's Ball, the "Effective Teaching Contest," and the "All-Engineering Convocation" were among the events sponsored by the Engineering Council, the latter two events in cooperation with the Technograph.

The attendance at St. Pat's Ball, although not large percentage-wise, indicates that Huff Gymnasium will again be used for the affair next year. The society displays, bigger and better than last year's, played an important part in attracting the engineers and their dates. Probably a little more emphasis on the Queen Contest and displays during the time of ticket sales next year would attract many more than this year.

The favorable comments, unsolicited, concerning the Effective Teaching Contest and Convocation indicate clearly that both events will be continued next year. A larger vote will be cast, if more publicity is given to this worth-while project.

At the time of this writing, it is still undecided whether the "Electrical Show" or "Engineering Open House" will be presented next spring. The Engineering Council, sponsors of the Open House in past years, has been given the privilege of deciding which show will be presented. Because the Council attempted to arrange for the Open House this year, it is logical to assume that it will be presented next year, if the "precedent" of Electrical Show on even numbered years—Open House on odd number years—is overlooked.

At any rate, with all the above mentioned events taking place, and possibly a few extra events, brought about by energetic students, the '49-'50 school term appears to be one that shouldn't be missed.

All this brings us to the point where we realize that not one of these events can be a success without the whole-hearted cooperation of every engineering student. It is the student's duty, to himself and other students, to see to it that every ounce of effort is expended to make each and every endeavor of the societies, the Engineering Council, and other student organizations a complete success. We should all strive to bring about an engineering student body that is closely meshed. So close, in fact, that all activities of the organizations of the college are common knowledge to all engineering students. Then we will be certain that ours is a "North Campus—second to none."

Ingenuity scores with "Ping Pong Balls"

A novel use of plastic spheres, looking for all the world like ping pong balls, has been made by engineers at Western Electric — manufacturing unit of the Bell Telephone System.

Formerly, when piece parts were immersed in this 45-foot tank to receive protective coats of chromium, the surface of the liquid foamed up—gasses were given off—the solution was dissipated. How to conserve the expensive chromic acid plating solution was the question.

An ingenious answer was found by Western's engineers—special "ping pong balls" made of an almost non-inflammable plastic. With some 10,000 of them crowding the surface, the solution gets little chance to weaken itself by foaming up.

Voice Lifter

Important among recent additions to Bell telephone apparatus is the V-3 Repeater—a combination of two amplifiers used to give weakened voice currents a "lift" on long distance telephone circuits.

When the development of an improved amplifier was initiated by Bell Telephone Laboratories, engineers at Western Electric were asked to help perfect the design for economical production in large quantities. They contributed much to simplified design, planned a new production line, new tools and techniques, new testing equipment. Result: an amplifier 1/6 the size of its predecessor, costing considerably less, and one that—in case of failure—can be replaced in a matter of seconds.

This is another example of how Western Electric engineers help make Bell telephone service the world's best at low cost.

Engineering problems *are many and varied at Western Electric, where manufacturing telephone and radio apparatus for the Bell System is the primary job. Engineers of many kinds—electrical, mechanical, industrial, chemical, metallurgical—are constantly working to devise and improve machines and processes for production of highest quality communications equipment.*

Western Electric

A UNIT OF THE BELL SYSTEM SINCE 1882

THERMISTORS . . .

(Continued from page 7)

properties of the latter. A semi-conductor may be defined as a substance whose electrical conductivity near or at room temperature is much less than that of typical metals but much greater than that of typical insulators. While no sharp boundaries exist between these classes of conductors, one might say that semi-conductors have specific resistances at room temperature from 0.1 to 10^9 ohm-centimeters. Semi-conductors usually have high negative temperature coefficients of resistance. As the temperature is increased from 0° C., to 300° C., the resistance may decrease by a factor of a thousand. Over this same temperature range the resistance of a typical metal such as platinum will increase by a factor of two. The resistance temperature curves for the two common types of thermistor materials are shown in Figure 2. Material No. 1 is produced by the powder metallurgy methods and is composed of manganese and nickel oxides. The specific resistance of this material is approximately ten times that of the No. 2 material at room temperature. This material is used when high resistance and stability at high temperatures are desired. Material No. 2 is the same as the No. 1 material except for the addition of cobalt oxide. The No. 2 material is used in applications where low resistance and limitations on physical dimensions are important. Some types of thermistors have been developed which have a temperature coefficient of electrical resistivity as great as 1.5 per cent per degree centigrade. Since the specific resistance of these electronic devices cover a wide range, considerable flexibility of design is possible.

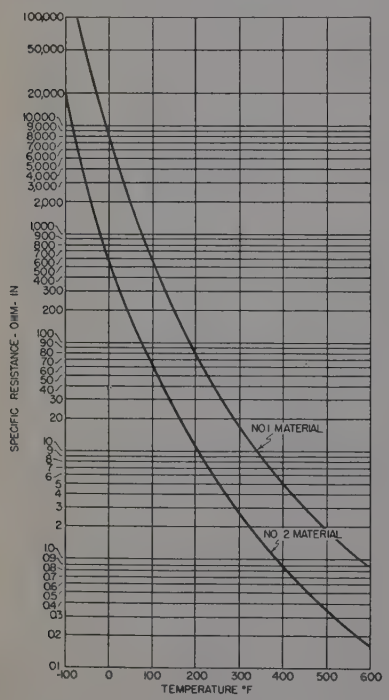

Fig. 2. Resistance - temperature curves for No. 1 and No. 2 G.-E. thermistors. (Courtesy of General Electrical.)

A thermistor will pass a current proportional to the applied potential difference when the current is low and no heating of the element is effected. However, when the current is of sufficient magnitude the thermistor will heat up internally. There is a corresponding decrease in resistance allowing more current to flow. The final magnitude of the current must be limited by the resistance of the exterior circuit.

The change in resistance does not occur instantaneously with variations in ambient temperature. Nor does it vary simultaneously with current but rather with the thermal capacity of the element. This time delay characteristic is useful in many applications. By proper design of the circuit and the thermistor it is possible to vary the time delay from a few milliseconds to several minutes.

Operation and Uses of Thermistors

The operation of a thermistor, as has been indicated, is a function of the change in resistance. It is surprising that the versatility of the device can result from a temperature dependent resistance characteristic alone. However, this effect produces a very useful non-linear volt-ampere relationship. This relationship and the great flexibility in shape and size results in the application in diverse fields. The variables of design are many and inter-related, including electrical, thermal and mechanical dimensions.

The more important uses of thermistors as indication, control and circuit elements will be discussed, grouping the uses as they fall under the primary characteristics: resistance-temperature, volt-ampere, and current-time, or dynamic relations.

The resistance-temperature phase has been mentioned but the variation in resistance may be accomplished by three methods. 1. External—by changes in the temperature, pressure, conductivity, or velocity of the matter surrounding the thermistor.

2. Direct—by internal resistance heating brought about by passing a current through the thermistor.

3. Indirect—by controlled heating of the thermistor body using an external source of heat, such as resistance coil, to produce the desired ambient temperature.

The large value of the temperature coefficient of thermistors permits a new order of sensitivity to be obtained when the usual principles of resistance thermometry are followed. Thermistor thermometers have long time stability which is good for temperatures up to 300° C. and excellent for more moderate temperatures. A well-aged thermistor used in precision measurements was found to be within 0.01° C. of its calibration after two months use at various temperatures up to 100° C. Conventional bridge or other resistance measuring circuits are commonly employed with thermistors. In the application shown in Figure 3 the current passing through the element is kept low so that no appreciable self-heating occurs. The instrument is calibrated and read as a thermometer since the resistance of the thermistor is solely dependent on the ambient temperature.

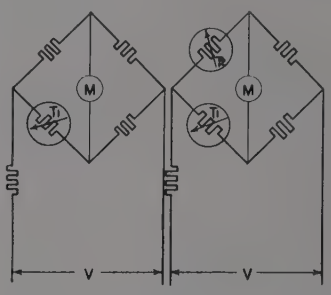

Fig. 3. Absolute and differential temperature measurement using thermistors. (Courtesy of General Electric.)

Since thermistors are readily designed for higher resistance values than metallic resistance thermometers or thermocouples, lead resistances are not ordinarily bothersome. Hence the temperature sensitive element can be remotely located from its associated measuring circuit. Variations in temperature may be transmitted automatically from distant locations by wire lines or by radio. This is especially helpful in meteorological studies and permits the study of several different temperatures by one operator. For the temperature of objects which are inaccessible, in motion or too hot for contact, thermometry can be determined by permitting radiation from the object to be focussed on a suitable thermistor by means of an ellipitical mirror.

The use of thermistors for temperature control purposes is closely related to their application as temperature measuring devices. The high temperature sensitivity previously mentioned makes the thermistor ideal in this respect. For most applications the thermistor is inserted in a simple relay circuit such as shown in Figure 4. As the temperature increases, there is a corresponding increase in current through the element. At a predetermined current value, the thermistor actuates a relay which in turn operates equipment controlling temperatures. As before, care must be taken not to permit

(Continued on page 22)

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THERMISTORS . . .

(Continued from page 20)

self-heating of the thermistor. This application is used in aircraft engines, refrigeration, chemical and food processing, air conditioning systems, and heating systems.

The volt-ampere and allied resistance power characteristics have resulted in the use of thermistors as sensitive power measuring devices and as automatically variable resistances for output amplitude controls for oscillators and amplifiers. To permit their use in these applications for d-c as well as a-c circuits, non-polarizing semi-conductors alone are employed in thermistors. The small capacitive effect of the thermistor and its ability to stand severe overloads without change in calibration and its ease of calibration with d-c or low-frequency power have a special use in ultra- and very-high frequency ranges as power measuring elements. For this application the thermistor is used as a power absorbing terminating resistance in the transmission line, which may be of Lecher, co-axial, or wave-guide form.

In previously discussed applications of the thermistor, care was taken to limit the current passing through the element to avoid self-heating. However, in use as a vacuum gage the heating power as generated by the copper loss is employed. The temperature of the element will rise until it reaches a state of equilibrium as determined by the rate of heat transfer to the surrounding medium.

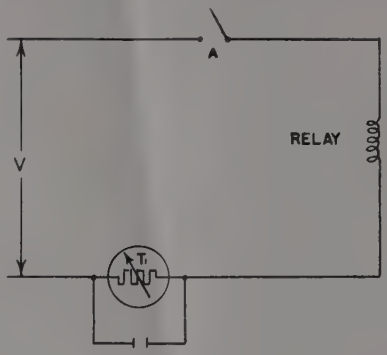


Fig. 4. Time delay relay circuit employing a thermistor. (Courtesy of General Electric.)

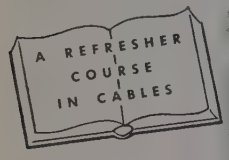
The inherent thermal inertia of the thermistor, previously described, makes for a good time delay device. In Figure 4 a typical circuit is shown. When switch A is closed, the initial current is limited by the cold resistance of the thermistor. As the current continues to flow through the element, self-heating takes place and resistance is lowered. This increases with reduced resistance, and at a predetermined value of current, the relay is actuated. Time delay characteristics of the thermistors are modified by changes in ambient temperature and self-heating of the element. This is accomplished by short circuiting the element as soon as the relay is pulled up. This permits the element to cool immediately and it is soon ready for re-use.

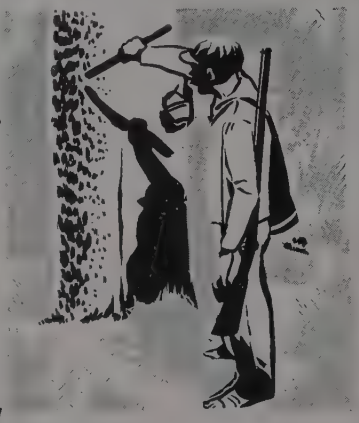
The uses of the thermistor as outlined are but a few of the many applications of this versatile unit. At present the thermally sensitive resistor has probably excited more interest as a major electric circuit element than any other except the vacuum tube. Laboratory use of thermistors as oscillators, modulators, and amplifiers for the low frequency and audio range foretell an even wider circle of activity for this fairly recent discovery.

Man must be disappointed with the lesser things of life before he can comprehend the full value of the greater. —Bulwer.

The probability that we may fail in the struggle ought not to deter us from the support of a cause we believe to be just.—Abraham Lincoln.

Car speeds on main rural roads last year averaged 46.8 miles an hour, as compared to the prewar average of 47.1 miles an hour.





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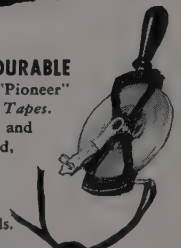

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CHEM BUILDING . . .

(Continued from page 12)

stage compressor handling five cubic feet per minute, and up to 15,000 psi. The other, a hydraulic pump, will develop pressures up to 30,000 psi. There will also be a high pressure gas storage shelter. All of the equipment which is now located in the high pressure laboratory situated near the Physical Plant building will be moved into the new laboratory.

No classes will be scheduled to use this laboratory, as it will be used to continue the research program which has been conducted at the University for over 20 years. Much work has been done on the behavior of gases at high pressures and near the critical point, and on high pressure reactions and syntheses. This has already resulted in the discovery of much important information, and the new laboratory should prove to be an aid in further work.

There will be a compressor room, for student use, adjoining the unit operations laboratory. The main compressor unit there will deliver 300 cubic feet of air per minute at 125 pounds gauge; and there will also be other smaller units, two fans, and a cycloidal blower.

Two other laboratories, intended primarily for research, are the new electrochemical and electroplating rooms. However, these will be used in conjunction with the unit projects laboratory. In them will be the complete pilot plant equipment for electrolytic operations. There will be standard tanks up to 35 and 50 gallon capacities, and a large trough in the floor to facilitate washing plated parts and handling solutions.

Students studying unit processes will henceforth use the new unit process laboratory in this building. It will be equipped with a distillation column and pilot plant equipment. There will be two floor levels in this laboratory, with two working mezzanines of iron grillwork located in one part. It will also contain conventional laboratory benches, and in addition, specially designed pipe frameworks on which the students will erect equipment for their own projects.

The process and development laboratory is also two stories high. Direct connections to the stacks through the walls are available. Equipment now located in a laboratory in the Abbott power plant will be transferred here.

The new instrumentation laboratory is designed completely for undergraduates in chemical engineering. In it will be 10 benches, each equipped with compressed air, vacuum, gas, electricity, and hot and cold water outlets. All students taking Ch.E. 267 will use this laboratory.

A new feature included in this building is the computing rooms, which are situated on the third floor. Here, small groups of students will be able to work together in evaluating data and calculating results of laboratory experiments. Eventually, most of these will contain a computing machine.

There are many smaller laboratories in the new building which are designed for special purposes. A boiler water research room will be set up and equipment from the present frame building on North campus will be moved into it. A low temperature room in which temperatures as low as —40 degrees Fahrenheit can be maintained, a constant temperature room, and a constant humidity room, are other new features.

Other new facilities for chemical engineering include a drafting room for the equipment design course, Ch.E. 381, a blue printing room, two dark rooms, machine shops, a furnace room, and a small kitchen.

There are also about 20 research rooms, ranging in size from 8 x 15 feet to 20 x 30 feet. They will have no special apparatus, but each will contain a bench and a pipe framework.

Three new class rooms, about 10 offices, a seminar room, and a lecture hall accommodating 200 students will furnish additional lecture and discussion space.

The building is designed for the chem-

(Continued on page 26)

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STANDARD

STANDARD SERVICE

CHEM BUILDING . . .

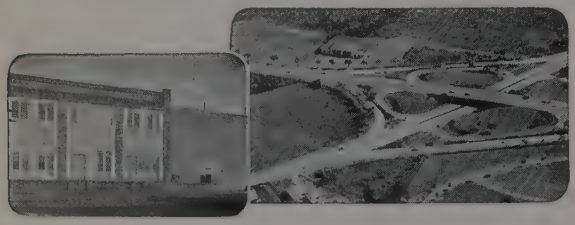
(Continued from page 24)

ical engineering and the biochemistry divisions. The latter will use the fourth and fifth floors, and will have a laboratory on the ground floor. A room will be completely equipped for running Kjedahl nitrogen analyses, and there will be available space for working with rats. There will be quarters for keeping and feeding them, an operating room, a metabolism room, and a general experiment room. The offices of this division will also be moved to the new building.

This building should prove to be a definite aid to much of the research which has been conducted at the University, and will provide better laboratory facilities for undergraduates. Students and faculty will have at their disposal a variety of new chemical engineering equipment, and modern quarters in which to use it.

If we achieve by hard work the thing we labor for, the enjoyment we receive is tenfold.—Ben Temple.

What sunshine is to flowers, smiles are to humanity. They are but trifles, to be sure; but, scattered along life's pathway, the good they do is inconceivable.—Addison.



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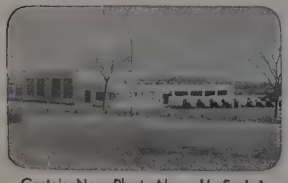

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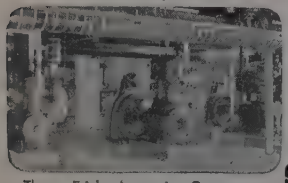

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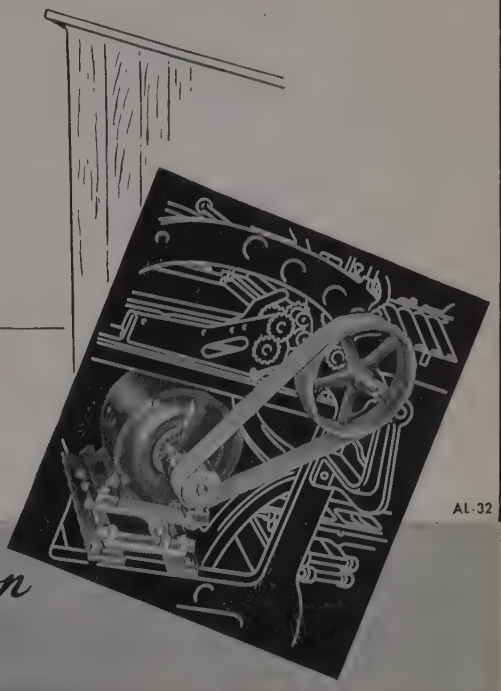

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M. E. LAB . . .

(Continued from page 13)

Besides the main room, there will be two smaller ones, each about 30 feet by 30 feet, which will be used by graduate students. Each will contain a 250-horsepower dynamometer. A six-cylinder, Continental, 145-horsepower, air-cooled engine will be attached to one of these dynamometers. Much equipment will be available for regulating the conditions under which the motor is running. Intake and exhaust pressures can be regulated, and the temperature of the intake air can be varied from —40° to 150° Farenheit. The quantity and humidity of intake air can also be regulated, so that conditions from below sea level to above 20,000 feet, and from the tropics to the poles can be simulated.

Two smaller rooms, one a fully equipped shop and the other a calculating room, will adjoin the laboratories and thus increase their usefulness. With all this equipment available, student engineers may look forward to improved combustion engine laboratory courses, making use of the best and most recent equipment.

A proverb is a short sentence based on long experience.—Cervantes.

NAVY PIER . . .

(Continued from page 14)

A.S.M.E.

During the past semester this organization has swelled its ranks and now has a total membership of 169. This has probably been one of the busiest semesters that the organization has in its records. They have been active in the formation of the Engineering Council and have had a full program. Some of the recent lectures the group has heard were by Mr. Schiebel of the Magnaflux corporation on the subject of "Non-destructive tests with Magnaflux and Zyglo," and Mrs. J. Pierce, secretary-treasurer of the Chicago section of the A.S.M.E., on the subject of "A Graduate Engineer's First Job." Many movies and field trips have also highlighted the program, and the officers of this organization would like to thank all the people that helped make this past semester's program a success.

A.I.E.E.

Election of officers was held at the meeting of February 22, with the following results: Harry Quinn, president; John Doering, vice president; Don Jackson, secretary; Steve Cook, treasurer; and Dale Hileman, Council representative. Dr. Harris was present as guest speaker and discussed, in his inimitable fashion, "Adventures in Research."

At the meeting held on April 5th, Mr. Edward J. Wolff, a consultant engineer, spoke on "Professional Engineering License Laws" and "Coordination of Engineer and Architect on a Project."

NAVY PIER STAFF

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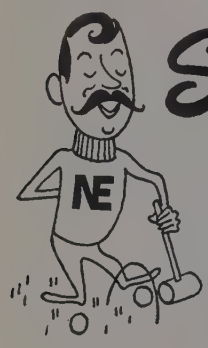
A young woman found a delightfully secluded, beautiful, quiet pool. Warm from her walk, she decided to take a plunge.

To dry herself she leaned back upon the soft, mossy bank. Suddenly she heard a noise and thought it must be one of the neighbor's little boys. So she called, "How old are you, little boy?"

A voice replied, "Ninety-six, dammit!"



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DU PONT Digest
For Students of Science and Engineering

TEN UNIVERSITIES TO BENEFIT BY GRANTS FOR UNRESTRICTED FUNDAMENTAL RESEARCH

With a view to stock-piling basic knowledge, the Du Pont Company has announced a program of grants-in-aid for the college year 1949-50 to 10 universities for unrestricted use in the field of fundamental research in chemistry.

The grants-in-aid of $10,000 each are to be used for research that has no immediate commercial goal. The universities themselves are to select the projects in which the grants will be employed, and results of the research are to be freely available for publication.

Du Pont's purpose in offering the grants is to help insure the flow of fundamental knowledge in science upon which the future industrial development of our country is so dependent. It is intended that the funds be utilized for such expenses as employing additional research personnel or lightening the teaching load of a professor who is eminently capable of research of a high order. They may also be expended for the purpose of obtaining supplies, apparatus or equipment.

This program of grants-in-aid is largely experimental. However, it is Du Pont's hope, should the program work out satisfactorily, to continue each grant for a period of five years.

The 10 universities to which grants-in-aid are being offered are California Institute of Technology, Cornell, Harvard, Massachusetts Institute of Technology, Ohio State, Princeton, Yale, Illinois, Minnesota and Wisconsin. Du Pont fellowships are also offered at these institutions.

Four of Many Outstanding Du Pont Fellowship Winners

STANLEY

MARVEL

WALKER

FAWCETT

Dr. Wendell M. Stanley, at University of California, is Chairman of the Department of Biochemistry in Berkeley and in the Medical School at San Francisco; Director of the Virus Laboratory. Bachelor's degree at Earlham College, 1926; M.S. at Illinois, 1927 and Ph.D. in Organic Chemistry, 1929. Honorary Doctor's degrees from five prominent American universities and the University of Paris. Has received more than 10 medals and awards for distinguished work in chemistry and biochemistry; co-recipient of the Nobel Prize in Chemistry in 1946. Du Pont fellow at Illinois in 1928-29.

Dr. Carl S. Marvel, Professor of Organic Chemistry at the University of Illinois since 1930, received his A.B. at Illinois Wesleyan University in 1915; A.M. at Illinois, 1916 and Ph.D. in Organic Chemistry, 1920; Sc.D. (honorary) at Illinois Wesleyan, 1946. President American Chemical Society, 1945; Director 1944-46. Has received numerous honors such as the Nichols Medal and memorial lectureships at outstanding universities. Du Pont fellow at Illinois in 1919-20. Consultant on Organic Chemistry to the Du Pont Company at present.

J. Frederic Walker is a Research Supervisor on formaldehyde products in the Electrochemicals Department. Trained at Massachusetts Institute of Technology. Awarded Bachelor's degree in Chemistry, 1925; Master's degree 1928, Ph.D. in Organic Chemistry, 1929. Author: "Formaldehyde Chemistry," "Organic Chemistry of Sodium," "History of Chemistry." Du Pont fellow in 1926-27.

Frank S. Fawcett is now doing synthetic organic research with Du Pont's Chemical Department. Received Bachelor's degree in Chemistry, Furman University, 1940; Master's degree Pennsylvania, 1944; Ph.D. in Organic Chemistry, Massachusetts Institute of Technology, 1948. Du Pont fellow at M.I.T. in academic year 1947-48.

77 DU PONT FELLOWSHIPS MADE AVAILABLE TO GRADUATE STUDENTS

Again in the academic year 1949-50, the Du Pont Company is awarding post-graduate and post-doctorate fellowships to universities throughout the country.

This is a continuation of the company's 30-year-old plan to encourage advanced studies in the fields of chemistry, physics, metallurgy, and engineering.

It is hoped that the plan will continue to help maintain the flow of technically trained men and women who will go into teaching and research work at the universities and into technical positions in industry. Some of them, as in past years, may come to work for Du Pont when they finish their studies, but there is no obligation to do so; fellowship holders are free to enter any field of activity they choose.

What Fellowships Provide

Each post-graduate fellowship provides $1,200 for a single person or $1,800 for a married person, together with an award of $1,000 to the university towards tuition and fees. Each post-doctoral fellowship provides $3,000 for the recipient and $1,500 to the university.

The students and their research subjects will be selected by authorities of the 47 universities participating. In this year's program, 45 of the post-graduate fellowships are in chemistry, 4 in physics, 15 in chemical engineering, 5 in mechanical engineering and 2 in metallurgy. There will be 6 post-doctoral fellowships as an incentive to those who would prefer to remain in academic work in order to obtain additional advanced training in chemistry.

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SPECTROGRAPHS . . .

(Continued from page 11)

in the laboratory. To duplicate a sound, one refers to the pattern and blends the proper frequencies in the proper proportions as indicated by the spectrogram. Experimental work has already begun on a "playback" unit that runs the spectrogram through a device and delivers the original sound. The objective is not to compete with disc, wire or tape recordings, since the expense of the unit is quite high. Rather, the idea is to make possible a playback of hand or machine-drawn patterns to produce any sound effect desirable—even that of speech. It is not unthinkable that music, for example, may be drawn by hand, and full orchestral effects achieved at a single stroke of the pen.

These examples tend to illustrate important aspects of permanent-pattern spectrograms, but there exists another field devoted to the study of transient patterns, a field that has drawn the interest of many investigators.

Translator Spectrograph

In order to realize the full potentialities of visible speech for the deaf, methods of instantaneous presentation of transient patterns were devised. The object was to present to the eye the ever-changing patterns of sound analogous to the sustained conversations of normal life. The devices constructed were to give a visual display of the same type of spectrogram that has been discussed previously, except that it would be instantaneous and continuous.

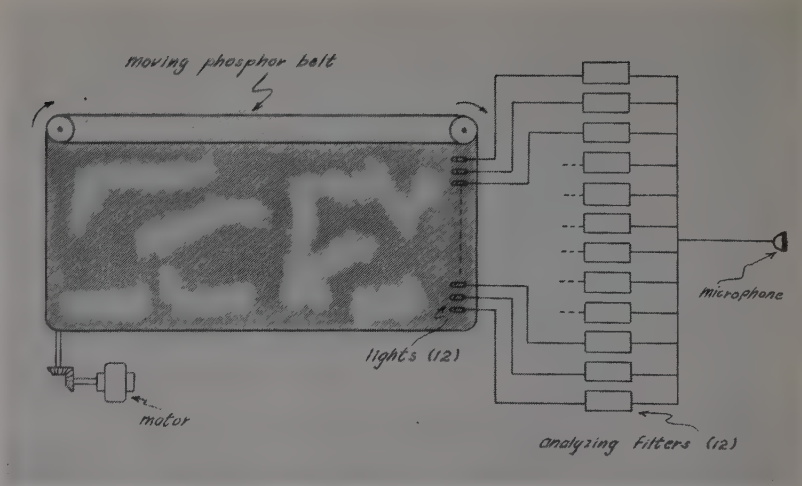

Fig. 4. A translator spectrograph is shown in the block diagram above. The pattern is made visible on the phosphorescent belt and is later automatically "erased."

Two basic forms of instantaneous translators are in use today. One depends upon the patterns produced on a rotating screen by a new type of cathode-ray tube. The other, which has been built successfully in the form of a portable unit, presents the display on a moving belt of phosphorescent material. Both rely upon a number of fixed filters covering the frequency bands that were normally scanned in successive cycles by the permanent-pattern spectrograph. The detail achieved in the instantaneous patterns is necessarily limited by the number of filters used. For the purpose of readability, however, as few as 12 filters (each of 300 cycle band-pass) may be used to cover a spectrum of 3,500 cycles.

In Figure 4 is shown a block schematic diagram of the moving-belt translator. Speech input is fed to 12 fixed analyzing filters and the output of each filter is used to modulate a grain-of-wheat incandescent lamp. As the moving phosphor belt passes beneath the row of lamps, traces of light are produced upon the dark surface of the belt. This makes an instantaneous spectrogram of the input voice signal. Not shown on the reverse side of the belt are several infrared lamps which erase the phosphorescence that has passed the angle of vision. After this infra-red quenching the belt is ready to start another trip past the exciting lamps. Whereas the permanent recorder produced a pattern of gray against a white background or a photographic transparency, both the cathode-ray and the moving-belt translators give pictures of varying brightness against a dark background.

Encouraging results in visual hearing has led to development of large console translators that are suitable for group teaching of the deaf. These more recent devices are fundamentally the same as the belt translator just described, but make use of larger displays.

(Continued on page 32)

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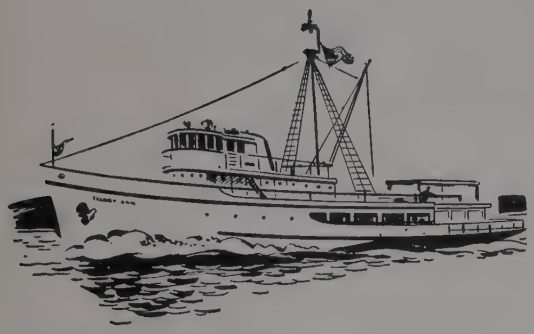

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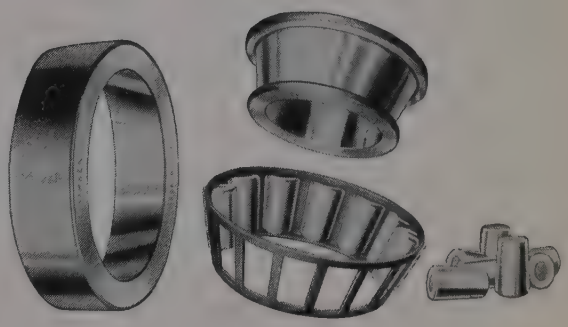

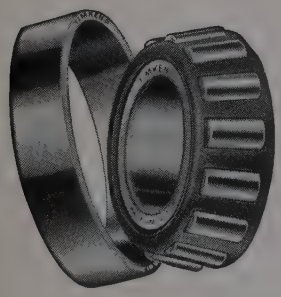

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SPECTROGRAPHS . . .

(Continued from page 30)

Results and Applications

Research has shown that the reading of printed material is accomplished by a succession of fixations in which the eyes focus briefly on a region of print and then move abruptly to fix attention upon the next group of characters. The results of reading tests show that the eye normally reads considerably faster than the average rate of speaking. There is, therefore, little time lag in reading speech with a visual translator.

The learning rate for the new "language" compares favorably with that for lip-reading. The process of visible speech, however, would permit the deaf to carry on telephone conversations where no amount of skill at lip-reading plays a part. As better training methods become available, there is little doubt that visual hearing instruction can be extended to cover the early school years of deaf children. The familiarity with visual patterns, if introduced at early ages, will lead to better facilities in reading sound.

Almost as important as reading sound is the ability for the deaf to speak and enunciate correctly. This has been one of the acute considerations for the totally deaf. Only in rare cases have the congenitally deaf been able to use their voices properly. Without the faculty of hearing one's own voice, there is a tendency for speech to degenerate and the voice to sound unnatural. This speech degeneration process has been observed to a marked degree in those whose hearing was lost some years after childhood. Conversation with such persons is difficult, and, in most instances, is nearly unintelligible.

The translators make it possible to show how a normal voice should sound; this has been of inestimable value in teaching the deaf to speak for the first time. In tests of congenitally deaf persons great progress has been made. Some

(Continued on page 36)

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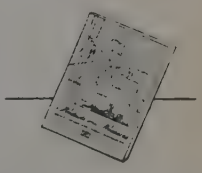

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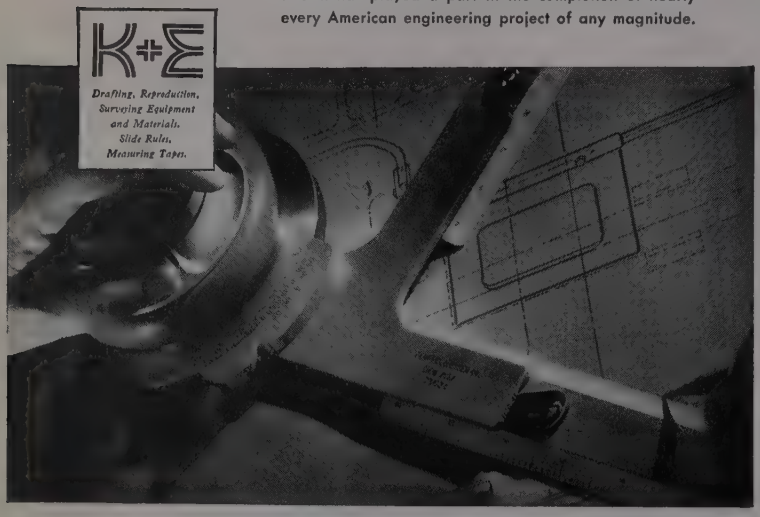

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DR. EVERITT . . .

(Continued from page 9)

lishment since 1946. He is a fellow and a director of the American Institute of Electrical Engineers, a member of the American Society for Engineering Education, the Acoustical Society of America, Illinois Society of Professional Engineers, Theta Chi, Tau Beta Pi (National Executive Council 1935-36), Sigma Xi, Phi Kappa Phi, Eta Kappa Nu, Pi Mu Epsilon, Iota Alpha, Gamma Alpha, and Pi Tau Sigma.

For diversion from these activities he finds relaxation in his photography, and enjoys swimming and tennis.

This fall Dr. Everitt will be leaving what has grown, in recent years, to be one of the largest departments of electrical engineering in the country, to take over the leadership of the University's second largest college—surpassed in size only by the College of Liberal Arts and Sciences.

Born in Baltimore, Maryland, on April 14, 1900, he was married on August 20, 1923, to the former Dorothy Wallace. They have three children, Barbara Alice, Bruce, and Pamela Ann. Versatility seems to run in the family. Barbara Alice entered Cornell university and became woman's editor of the Cornell Sun. Bruce is an electrical engineering student at this University and has been chairman of Homecoming and of the Spring Carnival this year.

CONVOCATION . . .

(Continued from page 8)

such a poll is infallible, but is only an indication of the students' personal viewpoint. Dr. Stoddard mentioned that the polls, on the other hand, were conducted for the good of all teachers, not to determine their popularity among the students, but to determine how effective their methods of teaching are. The "best" teacher is not necessarily the most effective teacher, Dr. Stoddard continued, and cited numerous examples of this condition.

Members of the convocation committee were Dale S. Glass, chairman, Phillip Doll, Richard Kanak and Allen Benson.

When a fool has made up his mind the market has gone by.

* * *

A great leader never sets himself above his followers except in carrying responsibilities.—Jules Ormont.

* * *

It does seem incredible that 3,500,000 laws are being made and still no improvement to the simple Ten Commandments.

* * *

Think wrongly, if you please; but in all cases think for yourself.—Lessing.

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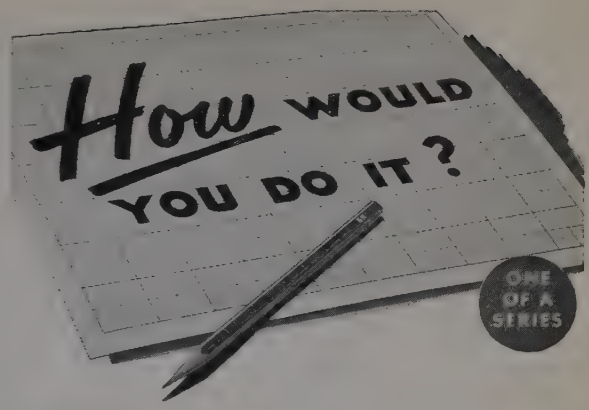

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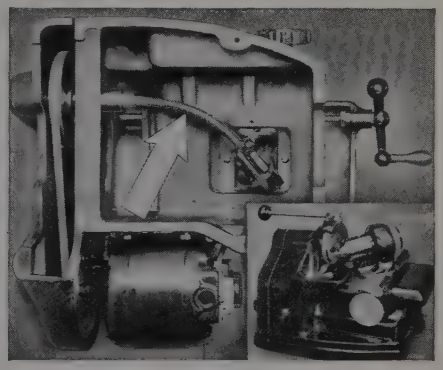

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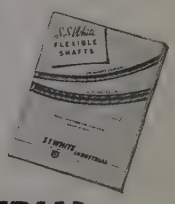

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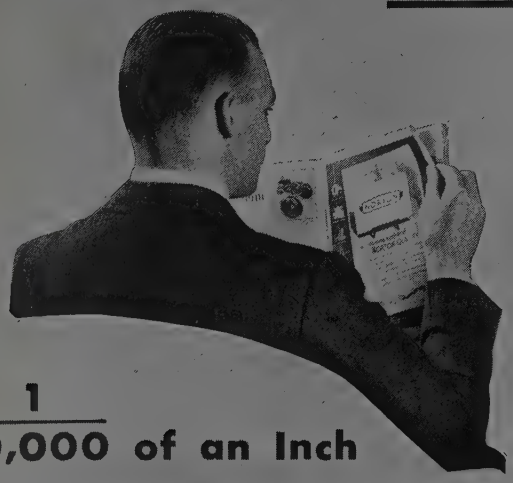

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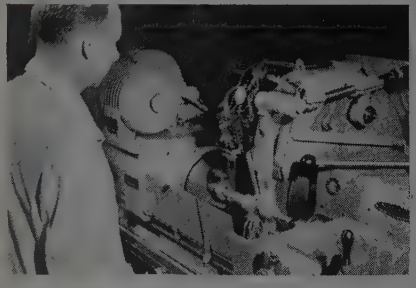
And many parts are still further refined, both for accuracy and surface finish, by Norton lapping machines. The work turned out on a production basis by these unique Norton machines is measured in *millionths of an inch* — must be gauged by complicated optical instruments making use of light rays.



When industry has a production problem which involves extreme accuracy or high surface finish, or both, it turns to Norton . . . for Norton has a large and capable staff of engineers, highly trained experts on abrasives, grinding wheels, grinding machines, and lapping machines.

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(Behr-Manning, Troy, N. Y. is a Norton Division)

NORTON

ABRASIVES — GRINDING WHEELS — GRINDING AND LAPPING MACHINES
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LABELING MACHINES (BEHR-MANNING DIVISION: COATED ABRASIVES AND SHARPENING STONES)

SPECTROGRAPHS . . .

(Continued from page 32)

of the deaf who have undertaken the speech training with visual translators are now able to speak with amazing distinctness and clarity.

Another point of interest is in the acoustic study of sounds other than human speech. Supersonic frequencies and very low frequency phenomena can be studied with the spectrograph by selecting filters to correspond to the desired frequency range. Of special interest in the low frequency range are heart beat oscillations. Tests of machinery noises have indicated definite frequency regions of greater prominence than others. By close observation of the separate frequency components in what usually appears to be a random noise region, much information is obtained on particular machine parts that do not function as smoothly as desired. Music has been mentioned in connection with hand-drawn play-back spectrograms, but the analysis of musical sounds is an important consideration in itself. New standards of harmonic content in an instrumental sound are within reach, and these criteria are entirely independent of the ear.

The sound spectrograph grew out of needs for more information on speech distortion in communication circuits, and much work still remains to be done in this field. The research to date has far from exhausted the possibilities for exploiting the study of speech and non-speech forms. The recent technique of visible sound proposes a stimulating number of entirely new ideas and has offered an important tool for further knowledge and discovery.

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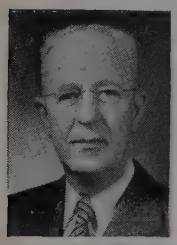
Get a Close-Up OF THE BASIC INDUSTRY OF YOUR CHOICE!

by R. S. FLESHIEM
Manager Electrical Department
ALLIS-CHALMERS MANUFACTURING CO.
(*Graduate Training Course—1904*)

WHEN YOU GET into daily working contact with an industry, you may find it offers specialized opportunites that you hadn't known about before. That's why it's not always possible—or wise—to pick *your* final spot in industry until you've had some all around first-hand experience.



R. S. FLESHIEM

I want to suggest a good way to *get* a close-up of the industries that appeal to you.

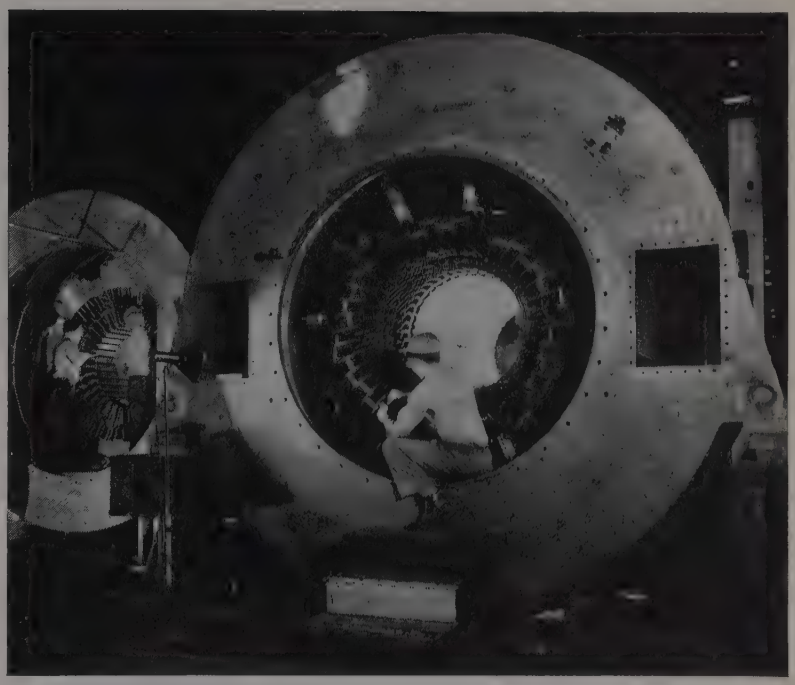
Naturally, I can talk with most assurance about the electric power industry. But the same principles apply to others.

When I got my engineering degree from the University of Michigan, the electric power industry was a fast-growing youngster. I decided to go to Allis-Chalmers, where I joined the company's first Graduate Training Course in 1904. I was sent to Cincinnati and started in the old Bullock Electric Mfg. Co. plant that Allis-Chalmers had purchased that same year. Bullock, incidentally, started in 1884—one of the real old-timers in the electric industry. It was the start of the present Allis-Chalmers Electrical Department.

Opportunities Are Increasing

The industry was growing fast at the turn of the century, but it's growing even faster now. Opportunities were never greater—or more varied.

Studying power and capacity factors in ore crushing, in Allis-Chalmers' complete basic industries laboratory. Camera-recorded data will be applied to commercial mining operations.



Inside View of a hydrogen-cooled steam-turbine generator. A-C Graduate Training Course students may follow important electric power equipment from blueprint to installation.

Today we have Graduate Training Course engineers applying their ability and training to the problems of machine design—research and development—manufacturing and production—sales—application engineering. Here we're working with electric power generation, control and utilization—with advanced industrial uses of electronics—with research in D. C. transmission. We're in intimate touch with the electric power industries—with transportation—with steel, metal working and other big power users. And I know that the field is just as broad in the other major industry departments here at Allis-Chalmers.

What Industry Interests You?

I firmly believe that Graduate Training Course engineers have a unique opportunity at Allis-Chalmers. They have the opportunity here to explore thoroughly not one, but many basic industries if they choose. This company produces the world's widest range of major industrial equipment, and every department is open to the graduate engineer. That includes electric power, mining and ore reduction, cement making, public works, steam turbines, pulp and wood processing. It also includes the full range of activities within each industry: design, manufacturing, sales, research, application, advertising.

Graduate students help plan their own courses at Allis-Chalmers, and they move around a good deal. It's possible for a man to come here with the idea of designing electrical equipment—later become interested in manufacturing—and finally find his greatest satisfaction and success in sales work. Men move from department to department, getting a practical working knowledge of each. And—the departments get to know the men. Opportunities present themselves according to ability.

At the completion of the Graduate Training Course, you've had a close-up of many industries. You're ready to take your place in the work of your choice.

Write for details of the Allis-Chalmers Graduate Training Course—requirements, salary, advantages. Representatives may visit your school. Watch for date.

Allis-Chalmers Manufacturing Company, Milwaukee 1, Wisconsin

ALLIS-CHALMERS

GALESBURG . . .

(Continued from page 15)

The course is covered in thirty days, and is designed to promote, through lectures and field trips, knowledge that would be equivalent to two years of "on the job" experience.

The field trips are made to give the men a better understanding of the processes of manufacturing. These dealers also gain common points of interest with the manufacturer, which they can use in selling their products.

Generally, the lectures are related to the field of engineering. Such courses as "blue print reading," "frame construction," "wood decay," "cement and concrete," "insulation," and "steel products" are offered. The lectures are given by men representing the manufacturers of the material being discussed, or by professors, both of whom have years of training and experience. Thus the lecturers are able to hand down facts about the quality of the material, maximum endurance under year-round all-weather conditions, and what is in the material that meets specifications.

The lumber man who knows these facts knows, when he builds, what to specify. He learns new uses, developed through changing trends, of old standbys in building materials. He also gains information on new materials. This is valuable when critical material shortages call for substitutes that can be depended upon.

Considering all, this course will help the lumber dealers to gain the wisdom to combat the obstacles presented by present day building conditions, and it will help prepare them for a future of keen competition.

NEW DEVELOPMENTS . . .

(Continued from page 2)

that the emulsion "comes very close to recording any nuclear particle," and compared an atomic particle in the emulsion to a "skipping stone" in a pond.

"Assuming one has a good, round, disk-like stone and throws with precision," he said, "the frequency of the skips increases toward the end of its path. . . .The faster the stone is travelling, the less the frequency of the skips on the water. This is paralleled by the passage of a high energy particle through a nuclear emulsion. As with the skipping stone, the rate of energy loss is reflected in the number of grains along the track. . . ."

Thus characteristics of a nuclear particle, such as speed and energy, can be determined from the length and curvature of the track and the grain spacing along it.

New Insulation

Johns-Manville has announced the development of Zerolite, a low-temperature insulation that has exceptional resistance to fire and chemicals. According to the manufacturer, this material combines high fire resistance, immunity to many organic solvents, and excellent moisture resistance with low heat conductivity. Zerolite was especially designed for service between -400°F. and 250°F.

If the power to do hard work is not talent, it is the best possible substitute for it.—J. A. Garfield.

* * *

If Americans can give an an example of the effectiveness of honest reasoning and spiritual responsibility, the whole world will take hope.—David Lawrence.

* * *

An ideal is the most practical thing in the world, for it is a force behind action that must be reckoned with by frankest materialist.—E. H. Griggs.

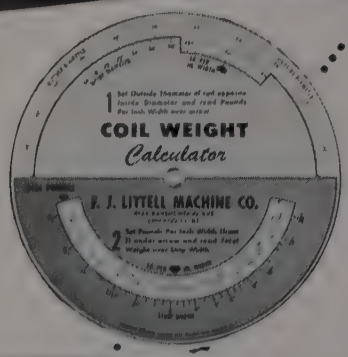
* * *

The thing that nourishes the root determines the fruit, be it tree or man.

Answers to Vocabulary

1-a, 2-d, 3-a, 4-c, 5-c, 6-d, 7-b, 8-a, 9-a, 10-d, 11-c, 12-b, 13-a, 14-d, 15-a.

Write for your FREE COPY!



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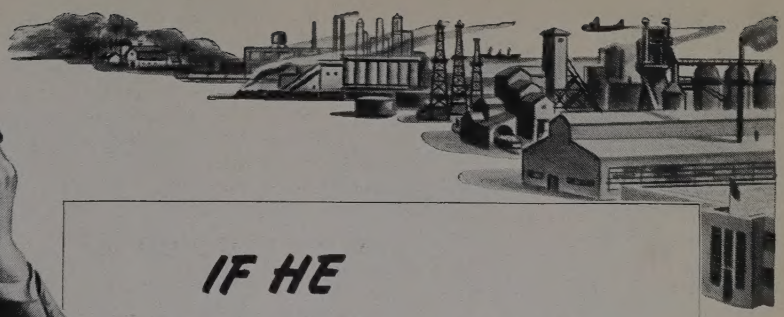

IF HE COLLECTED SAMPLES

as he made his rounds

For many years, ADVERTISEMENTS SUCH AS THIS ONE have appeared regularly in leading business magazines. Their primary purpose is to build acceptance for Square D Field Engineers, practically all of whom come to us from leading engineering schools such as yours.

A sample from every industry served by Square D Field Engineers would make quite a load, indeed. For these men serve as liaison between Square D and every segment of industrial America. Their full-time job is working with industries of every kind and size—helping find that "**better way to do it.**"

Through these Field Engineers, located in more than 50 offices in the United States, Canada and Mexico, Square D does its three-fold job: Designs and builds electrical distribution and control equipment in pace with present needs—provides sound counsel in the selection of the right equipment for any given application—anticipates trends and new methods and speeds their development.

If you have a problem in electrical distribution or control, call in the nearby Field Engineer. He'll help a lot in finding a "**better way to do it.**"

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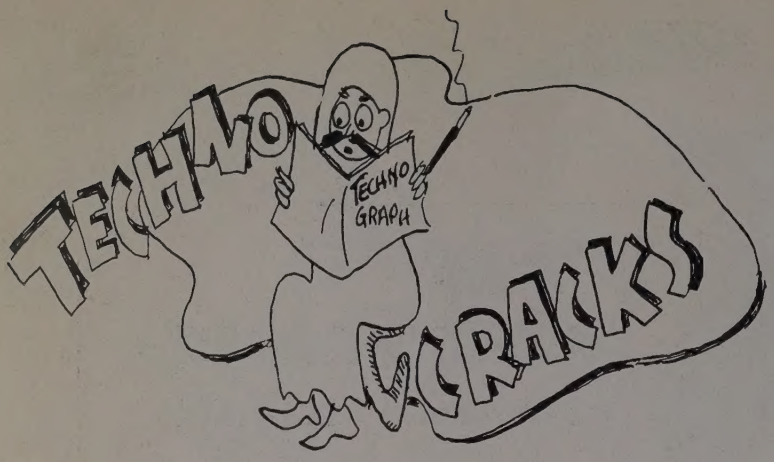


CONCENTRATION

I sat down at the type— no wait. I didn't sit down. . . . There was no chair. . . . I couldn't find it—we borrowed it one night for a brawl at Bidw—, I mean—that candy they sell at Bidw—, skip it!

I sat down at the typewriter and . . . Huh? . . . no, I don't know. . . . Sure, it's a typewriter. Look! 2hjl.,-98 765"&*?—it makes words. . . . Hey, leave him alone—that's a thoroughbred cutie—sure—got beautiful conformation and depth through the heart—sire was the famous Cootie-of-War—never lost a race in his life—had him with me since he was knee-high to a cockroach —I—Don, please don't hit me anymore. It makes my head ache. . . .I—.

I sat down at the typewriter and proceeded to—Ha! Ha! Fooled you! Bet you didn't think I'd get this far—got a wonderful power of concentration—like my old man—he's resident engineer up at Kankakee now—designs precast concreteless concrete bridges—good job, too—pays ten yen and twenty straight-jackets a month—he—I—.

I sat down at the typewriter and proceeded to rack my brains—brains—brains—. Saw some floating down the Boneyard this morning—some poor chump transferred—L.A.S. to engineering—took an E.E. 48 quiz—poor chap —brains exploded and they dumped him in the Boneyard. . . . *The Boneyard must be cleaned!* Sure I read Gene (Campus Scout) Shalit last year. However—as a veteran engineer I can also appreciate the more subtle and intrinsic merits of the Boneyard—after four years of its fragrance, —I—for Pete's sake! Will ya stop hitting me with that steam hammer? . . . which reminds me —steam hammer, I mean, —I must remember to mail off two box tops and two-bits for my steam hammer—I—.

I sat down at the typewriter and proceeded to rack my brains to think —yes, I *do* think—yes, . . . *no!* You don't say! Well, now that's very interesting—I wouldn't dream—which reminds me—dreams, I mean—dreamed that St. Pat was doing a T.A.M. 163 problem for me and he couldn't figure out this one constant so he got mad as anything and tore my K. & E. log-log-wood-log dirty-trig polyphase duplex —and I loved it so!

I sat down at the typewriter and proceeded to rack my brains to think of something that—that—that—that—*"that"*, pronoun. (AS, that, neut. nom. & acc. sing. of the demonstrative pron. and adj. also used as a relative pronoun). Equivalent to who or which, either sing, or pl.;—(now how the devil did Webster get in here?). . . . *Everyone wants to get into the act!* . . . Kill 'em! . . . Moider da bum! . . . Put 'em in Rhet 0! . . . (Horrible fate)—heard of an engineer who paid for his crimes at the hands of fellow engineers—he got an "A" on a Rhet theme the other day—the funeral will be conducted from 1522 W. Green St.

I sat down at the typewriter and proceeded to rack my brains to think of something that I could write to meet the oncoming deadline. The above stupid nonsense occurred to me and I wrote it down, for I wanted to conduct a little psychological experiment of my own. If you read this article through its entirity, then pat yourself on the back for being as average a dope as the rest of us, for it is amazing to observe how guiless and unwitting some people are who will read a silly article like this —through to—the—very—very—bitter —end.

Standing at the corner of Wright and Green were two engineers whose names were Wood and Stone. A pretty girl went by. Wood turned to Stone and Stone turned to Wood. Then both turned to rubber.

P. S. The girl turned into a drug store.

A hen, hit by an army jeep, got up, straightened out her feathers and said: "Lively little cuss . . . but he didn't get anywhere!"

* * *

He: "Every time I kiss you it makes me a better man!"

She: "Well, don't try to get to heaven in one night."

* * *

Deciding to teach her drunken husband a lesson, his wife dressed up in a devil's costume. That night when he came staggering home, all lushed up, she met him at the front door. Through his bleary, bloodshot eyes, he looked her over and said: "Who are you?"

"I'm the devil."

"Well, I'm sure glad to know you. I married your sister."

* * *

Two very cute coeds, slipping in late, met a couple more just going out. "Shhh, we're coming in after hours," said one of the entrants. Replied one of the others, "Think nothing of it. We're going out after ours."

* * *

"If you kiss me I'll call a member of my family," the town girl warned.

He kissed her.

"Bro*ther!*" she whispered.

* * *

A dilapidated car wheezed up to the toll gate of the Golden Gate bridge in San Francisco. Its last drop of gas was gone and its wornout tires were almost flopping in the breeze.

"Four-bits," demanded the bridge attendant briskly.

"Sold!" exclaimed the two weary M. E.'s.

* * *

A true music lover is a man who, upon hearing a soprano in the bathroom, puts his ear to the keyhole.

* * *

She: "So you want to kiss me! I didn't know you were that kind!"

He: "Baby, I'm even kinder than that!"

* * *

And puppy love is just a prelude to a dog's life.

* * *

"Wife: "John, dear, I'm going to appear in an amateur theatrical. What do you think folks would say if I wore tights?"

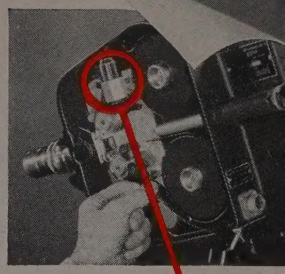
John: "That I married you for your money."

* * *

A Texan entered a salon with his wife and three-year-old child. "Two straight whiskeys," he said.

"Hey Pa," the kid asked, "ain't Ma drinkin'?"

Argon "timer" on Kodak High Speed Camera puts edge marks on film, as shown below, for externally fed rectangular pulses.



Splitting a second of action into 3000 measured parts

The Kodak High Speed Camera . . . a precision instrument that gives you exact visual answers to complex industrial time-motion problems.

WHEN high speed machinery doesn't work as it should or wears out too soon . . . when you need to know how fast-moving liquids behave . . . when any complex time-motion problem confronts you . . . try motion analysis with the Kodak High Speed Camera.

By taking pictures up to 3000 frames a second and showing them at regular speeds . . . you visually slow down action almost 200 times! And flash marks which the camera puts along the film edge time any phase of action in fractions of milliseconds.

By using this precision instrument in your laboratory or plant, you can track down and measure almost any problem in flexure, inertia, waste motion . . . analyze chemical and electrical phenomena for permanent record . . . for study . . . for group discussion.

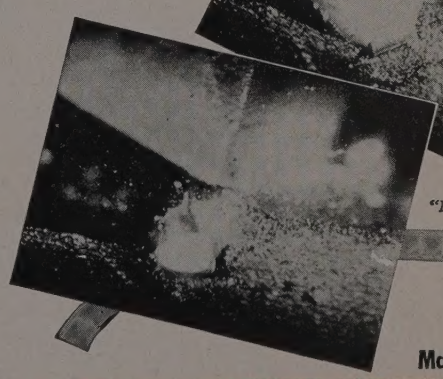
Send the coupon for a copy of the booklet "Magnifying Time." It will tell you how this instrument is being used advantageously in many industries.

EASTMAN KODAK COMPANY
Industrial Photographic Division, Rochester 4, N. Y.

High Speed Movies

. . . another important function of photography

Milling cutter bit caught in the act of breaking. Edge marks on film give the exact relative time and speed of any phase of high speed action.



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UNIQUE PLANT PRODUCES G-E SILICONES FOR INDUSTRY

On the outskirts of the little town of Waterford, N. Y. is one of the most unusual plants in the world.

New Waterford plant works night and day to produce silicones.

Where other new industrial structures may be impressive because of their physical size or tremendous productive capacity, the Waterford Works of General Electric is of interest because of the

Silicone oils are excellent mold release agents.

rare nature of the materials being produced there, and because of the new chemical processes involved in their manufacture.

Silicones from Sand

The primary raw material from which silicones are derived is sand. This basic ingredient is modified at Waterford through a complex series of pipes, tanks, stills, and reactors which are operated in a nearly automatic production system.

The most amazing property of silicones is that, like quartz, they are relatively unaffected by heat, cold, water, chemicals, and weather. But instead of being rigid, like quartz, silicones are flexible—they may take any form from liquid to solid! This flexibility permits them to be used in many

Silicone centers add new zip to U. S. Royal golf balls.

places where rigid materials with similar properties could not serve.

The finished silicone products are already being widely applied in industry, and new uses are constantly being found for them. Silicone rubber is being used for heat-resistant gaskets for aircraft and diesel engines, oven doors, and laboratory equipment. Silicone oils are excellent mold release agents for rubber and tire molders. Silicone resins promise to make possible paints and finishes of exceptional durability. Another product

Tank farm stores liquid raw materials which automatic process converts to silicones.

of G-E silicone research is called DRI-FILM*—water repellents that can be used on a variety of materials.

Put Waterford on Map

You'll be hearing a lot about G-E silicones. They're really going to put that little town of Waterford on the map.

Of course, silicones are only one of the products produced by the various divisions of the General Electric Chemical Department. It also manufactures Glyptal* alkyd resins, insulating materials, permanent magnets, plastics molding compounds, and is responsible for the plastics molding operations that have made G. E. one of the world's largest plastics manufacturers. For more information, write to the Chemical Department, General Electric Company, Pittsfield, Massachusetts.

*REG. U. S. PAT. OFF.

A message to students of chemistry and chemical engineering from

J. L. McMURPHY

Manager, Chemicals Division, G-E Chemical Department

"The new world of organo-silicon chemistry is a fascinating one—and one which promises an interesting future for a young man who wants to make chemistry his career. We at General Electric are expanding our silicone research and production to meet industry's growing need for silicones."

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